The Veterinary Record

FOUNDED BY WILLIAM HUNTING, F.R.C.V.S., 1888.

No. 24. JUNE 11, 1938. Vol. 50.

The Control of Contagious Abortion*

A. D. McEWEN, D.SC., M.R.C.V.S.

Veterinary Department, South-Eastern Agricultural College, Wye, Kent

Ten years ago a veterinary research worker in the United States who had contributed to our knowledge of contagious abortion, remarked to me that abortion was a subject that had been pretty well skimmed. I have no clear recollection of the rest of our conversation but that remark still stands out vividly for there was a profundity of truth in it. But despite the skimming of the first cream, contagious abortion in this country remains as serious an economic problem to-day as it was before the accumulated researches from Denmark, England, Germany and the United States had explained its aetiology and shown the way to methods of prevention. This is not a very comforting thought to anyone who wishes to see the results of research applied in the field. To-night I shall try to place before you some aspects of the problem, as I see it, with regard to the control of the disease. But before doing so we might summarise the more important knowledge which was familiar ten years ago.

It was accepted that the infected uterus, either at abortion or at an apparently normal full-time calving, was the most dangerous source for the spread of the infection, but that after parturition the uterus rapidly cleansed itself of infection and in three to four weeks *Br. abortus* was no longer found there. The udder was recognised as a predilection seat for the organisms and it might remain infected for years, *Br. abortus* being found in the milk. Although bulls might become infected in the testicles and epididymes they did not play an important rôle in the transmission of the infection. Calves were resistant to infection and seldom became permanently infected. Virgin heifers were more resistant than pregnant heifers and unserved cows if exposed to infection were less likely to abort than cows exposed during pregnancy. Feeding had been shown to be a ready means of producing the disease and it was known that bacteria could penetrate through the intact mucous membranes, and the instillation of bacteria into the conjunctival sac had been demonstrated a very certain method of infection.

Vaccination had been studied by many workers and reports on the use of vaccines on small groups of experimental cattle and in field trials were available. The former showed that vaccination with living virulent strains of *Br. abortus* reduced the abortion rate and the extent of the infection in experimental animals deliberately infected. Field trials tended to confirm these findings, but on account of the frequent indescriminate vaccination of all animals regardless of whether these were or were not infected before vaccination the results of field trials were sometimes difficult to assess. It was known that the vaccination of open cows with the virulent type of culture commonly used in vaccination experiments was capable of causing an udder infection and because of this, even though abortion might be prevented, strong exception was taken to the use of living vaccines, the relationship between infected milk and undulant fever having been well established. Vaccination was thus brought into some disrepute and many belittled the value of vaccination, dismissing it as a practical means of overcoming the infection in herds. Fortunately this uncompromising attitude was not adopted by many veterinarians who realised the impracticability of controlling the disease in the majority of herds by the removal of the infected animals, and methods of vaccination were already being explored which gave some promise of success and were free from the objectionable fault of causing infection in a number of the vaccinated animals. We are chiefly indebted to the American workers Huddleson, Cotton and Buck for these early efforts to find improved methods of immunisation.

Considerably more than ten years ago the serological diagnosis of *Brucella* infection of cattle had been well worked out and numerous comparisons between the agglutination test and the complement fixation test had been made. The former had given every bit as reliable results as the latter and on account of its greater simplicity it was used for routine

*Paper presented at a meeting of the Central Division, N.V.M.A., held at the Conway Hall, London, April 7th, 1938.

diagnosis. The limitations of both tests were recognised and both might miss a number of infected animals but detection of such infected non-reactors was likely to occur at a later test following parturition. Serological and allergic tests had been compared to some extent but the latter had not met with any general acceptance, showing no superiority to the agglutination test.

The control of the disease by repeated testing of the non-reacting stock and the isolation of reactors had been demonstrated as a means for the eradication of the disease in a considerable number of herds, particularly in the United States.

The relationship between *Br. abortus* infection of cattle and undulant fever had given a fresh impetus to the study of the excretion of the organisms from the udder and a relationship between the titre of the blood and the whey and the elimination of *Br. abortus* in the milk was recognised but there were occasional discrepancies as non-reacting animals might sometimes eliminate *Br. abortus* in their milk.

The close relationship between *Br. melitensis*, *Br. abortus* and *Br. suis* had been known for some years and the H_2S production test, and the bacteriostatic action of certain dyes were available for aid in the differentation of the species.

Br. abortus infection had been studied in laboratory animals, guinea-pigs, rabbits, mice and rats. The guinea-pig was the most susceptible of these and the most commonly used for diagnostic purposes. In infected guinea-pigs the most constant lesion was an enlargement of the spleen but microscopic lesions were demonstrable in practically all organs. Laboratory animals had not been successfully immunised against the somewhat chronic type of disease caused by *Br. abortus* but comparatively little attention had been devoted to this side of the study.

The foregoing brief remarks summarise some of the most important facts concerning contagious abortion as they were recognised ten and more years ago.

We may now consider in some detail the possibilities of applying this knowledge together with what has since been acquired to the control of the disease, considering first of all methods of eradication and later discuss the possibilities of immunisation.

Plans for the control of contagious abortion by testing and the isolation of reacting cattle with a view to the eventual eradication of the disease from individual herds have and do vary in points of detail, but it is likely that the more rigorous the testing and the isolation of infected animals the greater will be the chances of success. This may not be evident from experience in isolated instances nor from the study of the results in a few herds. But we have to remember that the epidemiology of the disease varies greatly from herd to herd and chance is probably the most important factor here concerned. It is not usual to find 50 per cent. of cows in ordinary herds reacting to the agglutination test, although sometimes this percentage may be greatly exceeded. As many non-reactors have been in an infected environment for considerable periods of time it may be concluded that the opportunities or the chances of animals becoming infected vary greatly for one cause or another. It is probable, should control measures commence while conditions favouring the spread of infection are or have recently been actively operating, that control will be much more difficult to enforce than under the reverse set of circumstances. Therefore under one set of circumstances what appear to be very thorough measures of testing and isolation may seem relatively ineffectual in bringing the disease under control while under other circumstances measures not so thoroughly applied may bring quick success. If one were to choose a time to commence eradication one would prefer to start during a period when the clinical manifestations of the disease were in abeyance rather than immediately following a period when many abortions had occurred.

The principles of any plan of eradication embody the regular testing of the non-reacting portion of the herd at comparatively short intervals and the removal of the reactors. It is furthermore desirable to isolate the non-reactors at the time of parturition, and test them after parturition, before returning them to the non-reacting herd. This latter precaution is particularly useful during the first year or two as it is realised that some infected cows react shortly before or after calving or aborting. Provided all the cows have passed through a complete pregnancy, no case of infection having been found in the meantime, the isolation at calving might be dropped. In practice, however, if the hygienic habit of isolation at parturition has been acquired it is not found irksome and should not be discontinued. When the stage is reached where the disease has been controlled and infection eliminated the herd tests may be made at longer intervals. When isolation is rigorously enforced and the tests regularly made it is my experience that the eradication of contagious abortion is no more difficult but probably easier than the eradication of tuberculosis.

As the owner is under no obligation to dispose of his reacting cows and as there is no monetary assistance which he will lose if he does not remove them from the tested herd it follows that in many cases abortion reacting

animals are not isolated from the non-reactors completely as is the case when animals react to the test for tuberculosis in tuberculin tested herds licensed by the Ministry of Health or participating in the Attested Herd Scheme.

The great stimulus to the eradication of tuberculosis from herds is the enhanced price for milk from tested herds. This may compensate and often more than compensate for the loss of occasional reacting cows. There is no similar compensation for the farmer trying to eradicate abortion, consequently I have never felt it advisable to recommend the sale of animals reacting to the agglutination test during the first few months following the commencement of control measures. Many owners have not the patience to follow even a simple plan for the control of a contagious disease when they see no immediate financial gain, and such men if they had sold the reacting cattle and a few months later ceased their efforts to control abortion would regret having parted with the animals and might become actively antagonistic to any eradication plan. In practice therefore reacting cattle are frequently kept as completely apart from the non-reactors as circumstances permit and sold or disposed of as favourable opportunities present themselves. As the completeness of isolation and the length of time reacting animals are maintained will vary from herd to herd so one might expect the chances of the success of the control to vary. But it appears to me that not until the control of contagious abortion is encouraged by a subsidy of some sort will it be possible to have any extensive plan put into operation where the conditions are favourable for the control of the disease, namely, the enforcement of the complete isolation of reacting animals immediately they are detected. The recruitment of tested herds from outside sources must be considered in any eradication scheme but this presents no greater difficulty than in the control of tuberculosis. However, pregnant animals must not enter abortion tested herds unless they themselves come from herds where the disease has been eradicated.

There are other minor matters in the eradication of contagious abortion which require solution, *e.g.* the standardisation of the methods of testing and of interpreting the test. Difficulties no doubt will arise regarding doubtful reactors but we need only refer to tuberculosis to find that neither tuberculin nor the tuberculin test can be standardised with any exactitude and that doubtful reactors occur, but despite these shortcomings the Ministry of Agriculture has faith in their ability to eradicate this disease. Ten years ago we had all the information necessary for plans for the eradication of contagious abortion. It was then as it still is, merely a question of deciding whether it was worth while paying in some way for the eradication of the disease on a wide scale. It is of course debatable whether this would be justifiable. The public health aspect of *Brucella* infection of animals in Great Britain is not serious and although contagious abortion is a major problem from the point of view of animal husbandry I feel that the tendency has been to exaggerate its importance. Many farmers with infected herds are so little embarrassed, apparently, by the disease that they will not make any persistent effort involving some inconveniences and trouble to eradicate the disease even though their facilities are sufficient to justify the effort and they may be saved all the expense of testing.

You will probably have gathered by this time that I have a belief in our ability to control contagious abortion, given the necessary, or I might say minimum, requirements for the control of a contagious disease of cattle. I have, however, very little faith that these requirements will be obtained on a large scale unless some other means can first be found of reducing the incidence of infection so that the immediate slaughter of reacting animals became a practical proposition. Hygienic measures undirected by testing will do little towards the control of the disease in individual herds and they are not in the least likely to affect the incidence of the disease as a whole.

Accordingly we may turn to immunisation and see whether this holds any hope for the eventual control of contagious abortion. Here at any rate we find a subject full of interest because, despite what has been done, only the fringe has been touched and immunisation contains many problems awaiting solution; eradication, on the other hand, was merely awaiting application. In the first place we know practically nothing as to why an animal through certain treatment becomes more resistant to *Br. abortus* infection; we are still vague as to what the defence mechanisms are and how they may be stimulated. No good reason has ever been found as to why considerable success has attended the use of living vaccines and practically none that of dead vaccines.

At one time it was generally thought that a tolerance to abortion was produced by a long-standing exposure to infection with large numbers of bacteria—the type of exposure which often occurs in a naturally infected animal—and in vaccination experiments this was imitated by giving massive inoculations of live virulent culture. But it is very doubtful whether immunity necessarily depends upon the response of the tissues to a lengthy exposure of living virulent bacteria.

As long as vaccination with living virulent

cultures of *Br. abortus* held out the only prospect of protection the bovine was almost the only animal used in immunisation experiments. But although the final tests of any immunity must be made in cattle the disregard of the smaller animals or the inability to use them profitably has, I feel, hampered research on immunity.

The majority of workers on the vaccination of cattle with virulent strains of *Br. abortus* report favourably on the resistance of the vaccinated animals to abortion. This method of vaccination, however, is open to the objections that it actually causes infection in non-infected animals some of which will in consequence excrete *Br. abortus* in their milk, and furthermore that the infection will be perpetuated by such vaccines. It is easy to exaggerate the importance of these objections, nevertheless safer and better methods of immunisation must be sought. As already mentioned, Huddleson more than ten years ago gave a lead in this direction when in 1924 he first reported on the use of a non-virulent living vaccine which failed to set up disease in guinea-pigs and did not cause infection in pregnant cattle. This strain caused agglutinins to appear in the serum of inoculated animals and to overcome this the strain was converted to a rough non-agglutinable type. Meyer and Huddleson (1936) have reported on the extensive use of this non-virulent rough strain in the field and the impression from their work is that vaccination did increase the resistance of the inoculated animals both to infection and to abortion.

Of equal interest are the reports of Buck; Cotton and Buck; Cotton, Buck and Smith on the vaccination of calves and the use of live vaccines prepared from strains of reduced virulence. These workers used limited numbers of experimental cattle for their experiments in which vaccinated and control animals were infected and the results readily assessed. Their findings may be summarised as follows:— Calves vaccinated with a strain of such low virulence that it failed to produce any lesions in inoculated guinea-pigs and caused agglutinins to appear in their serum only in low titre showed little resistance when exposed to infection nearly two years later. Calves vaccinated with a strain of relatively low virulence but which produced lesions in a percentage of inoculated guinea-pigs and agglutinins at relatively high titre were definitely resistant to *Br. abortus* infection two years later. Calves vaccinated with a fully virulent strain were definitely resistant to infection two years later. None of the calves appeared to become infected with the vaccine strains.

Formerly Buck had obtained some evidence that calves vaccinated with the least virulent of the strains possessed some degree of resistance in later life. These results were encouraging and suggested that strains of reduced virulence while incapable of establishing any permanent infection in calves nevertheless stimulated an immunity of considerable duration. Further work along similar lines was done on cattle vaccinated before service and again the non-virulent strains produced some immunity to infection. It was moreover indicated that pregnant animals vaccinated with the non-virulent strains were more resistant than controls.

The work quoted above therefore holds out the hope that vaccination during calfhood even with strains of reduced virulence or vaccination in later life with strains which do not infect may produce a useful means for combating the disease.

Although the majority of young animals exposed to infection or vaccinated with virulent strains may have a transient infection only, it is yet probable that in a few instances infection may persist into later life. This makes it desirable that any vaccine used should be so reduced in virulence that the chances of infection persisting are removed, or at least reduced to a minimum. Similar remarks apply to any vaccine used on heifers or cows. But even if vaccination were to infect the occasional animal, this would not justify vaccination being discarded if vaccination protected against a natural infection. A hopeful feature of calfhood vaccination and of the vaccination of older animals with vaccines of reduced virulence is that the agglutination titre tends to fade out, and therefore it may be perfectly feasible to commence with vaccination and when the disease has been controlled to discontinue vaccination and apply the eradication policy if this is thought preferable.

Probably the ideal policy regarding the use of a vaccine which did not cause infection but at the same time conferred some protection would be to vaccinate all non-reacting cattle including the young stock in an area and repeat the vaccinations as necessary. If the selected area contained 20,000 cattle, heifers and cows and the vaccination and marking of all stock were continued for a period of, say, ten years, during which time no infected cattle were allowed to be introduced into the area, it would be possible by comparing the incidence of udder infection, abortion and positive reactors before the commencement of the test with similar data collected at the end of the experiment to say whether Brucella infection had decreased and to what extent. Comparisons could also be made between the vaccinated area and other comparable areas where vaccination was not attempted. In any schemes of this kind abortion-free herds would have to be exempt.

Tests on these lines would give better information on the possibility of controlling the disease by immunisation than attempts to obtain records from scattered herds where vaccinated and control animals are kept but where movements into and out of the herds may frequently spoil the experiment. Before any decisive test such as the one suggested could be put into operation information has first to be gained by small investigations on limited numbers of experimental cattle, *e.g.*, a more intensive study of strains of *Br. abortus* of different degrees of virulence is called for and this would supply information not only regarding virulence but concerning immunising properties and the stabilisation of these properties. Comparisons must be made of different methods of inoculation, the ages of animals when the maximum immunity response may be obtained and the cellular and humoral responses accompanying immunity must be studied for their significance. The use of small experimental animals as well as cattle in these studies should be much more thoroughly explored and these might not only furnish a very helpful guide to the principles of immunity to *Br. abortus* but offer a practical means for the standardisation of vaccins. Coinciding with this work research should be actively prosecuted on the immunity response to lifeless bacteria and the different materials which may be fractionated from *Br. abortus*. Studies of this latter type had not started ten years ago and are still very much in the embryo stage.

In the improvement of our methods of immunisation and their application rest our brightest hopes of bringing contagious abortion under effective control—unless indeed an effective chemotherapeutic method of control is found—and in striving to this end there is the greatest need for the research worker: there is still cream for the worker who can make his or her contribution to a fuller knowledge of this disease. But research is not going to remove the thickest of the cream which will still persist, namely, a high incidence of infection in our herds. Ultimately this can only be removed by organised and unrelaxing veterinary and agricultural effort, and until this is made contagious abortion remains either a challenge to the usefulness of the veterinary service to the community or an admission that the cattle industry is so apathetic to a disease of long standing and its economic effects that the disease can be disregarded.

. . . . .

Discussion

Dr. A. W. Stableforth, who opened the discussion, said that Dr. McEwen had given them a comprehensive summary of the knowledge available regarding contagious abortion, both with regard to eradication on the basis of blood tests and with regard to vaccination. With most of Dr. McEwen's observations he was in wholehearted agreement; there were, however, certain aspects which he thought might usefully be pursued further. Dr. McEwen said that although we had had adequate knowledge of methods of controlling the disease by segregation methods for ten years or more, nothing very much had been done; that was a challenge to all concerned, including themselves individually, and he thought they might learn a little from a discussion of the possible reasons. He would refer to various points made by Dr. McEwen as they arose.

The main categories under which this aspect of the matter could be considered were (1) that control did not in fact work so well as had been anticipated; (2) that the disease was not the cause of serious loss; (3) that control by segregation was too costly; (4) that it was impossible in many herds and (5) as concerned the question of public opinion.

(1) He thought there could be no question regarding the usefulness of the control methods that had been laid down so well more than ten years ago. They had been tried on numerous farms in this country (as well as elsewhere) and found satisfactory. At the College (London), they were at present in contact with some 30 herds in which control measures, based on the separation of reactors and non-reactors to the blood test, were in operation and in the majority of cases the results were eminently satisfactory; good progress had been made or the disease had been eradicated, some herds having been free for several years. The agglutination test could be relied on—it did occasionally fail, but the conditions under which it was likely to fail were known and could usually be guarded against. A herd could nearly always be put on a satisfactory breeding basis within twelve months and often much sooner.

(2) Dr. McEwen thought that the loss from contagious abortion was much exaggerated. He was not going to agree with him there. From some of his own recently published results Dr. McEwen showed that in the herds of one area, containing a very large number of cows, over 10 per cent. had aborted; that was quite a considerable loss, and they knew that in many herds there was an abortion rate of 30 per cent. The loss resulted from (*a*) loss of the calf—a serious matter in a pedigree herd or where an attempt was being made to grade up generally; (*b*) loss of milk in the case of cows which aborted; while (*c*) it had been shown that there was also a certain loss of milk in cows which did not abort but which were infected. The interruption in the ordinary farm routine was also of importance because abortion prevented the proper planning of production to meet the milk contracts and, further, by depleting the

normal supply of calves it was necessary to keep all heifers, good or bad, or to buy from outside sources, instead of selecting only the best for purposes of maintenance. On the whole, he thought, the loss from abortion did amount to a very considerable total; indeed, he had no hesitation in saying that, apart from sterility—which was the summation effect of a variety of causes—abortion was a cause of greater loss than any other bovine disease; he put it before tuberculosis.

(3) Whilst it might be argued that the trouble and cost of eradicating abortion were considerable, the trouble and financial loss caused by the disease itself had also to be remembered. That it was a satisfactory proposition commercially was proved by the fact that it had been taken up and carried through enthusiastically by farmers whose main, if not sole, object was to make milk production pay.

(4) Eradication was, of course, impossible in probably at least 60 per cent. of herds in this country, simply because there was not sufficient pasture accommodation, because the houses were not sufficiently satisfactory, or because the herd was a "flying" herd and relied very largely on purchased animals. He thought, however, that there had been a mistake often made in the past of rather looking upon the eradication of contagious abortion—or any other disease—as the privilege of the rich man only: he could sell the reactors and replace them, or he had two farms, enabling him to put the reactors on one farm and the non-reactors on the other. It was not true, he submitted, that eradication was only possible for the rich man with extensive premises. There was no question that the ordinary commercial farmer, provided he had got sufficient grazing—that was the first essential —could attempt and achieve eradication; if he had two cowsheds so much the better, but with only one it was possible. They were in contact with such herds that had progressed perfectly satisfactorily. They did not want to emphasise too much the necessity for palatial buildings. There was one very great advantage for the small man, and that was that he took a personal interest, and personal interest and observation were worth a great deal.

(5) One reason why eradication had not been taken up more widely was probably because public opinion was not yet ripe for it. That, he thought, was partly their own fault because no great effort had been made in the past to educate farming opinion generally, to make farmers in any way eradication-conscious. In this respect there was a big contrast between the situation here and in, *e.g.*, North America, where, by a very considerable system of "extension lecturing," the farming community had been educated in what could be done, and this helped greatly. It was, of course, essential that public opinion should be moulded in this way before any general or state scheme, voluntary or compulsory, had a chance of being successful. A small example of what could be done by lecturing and demonstration had been provided in this country by the Ayrshire scheme for tuberculosis eradication. It was found that even when the experiment stopped and free testing and advice ceased, the farmers, having seen the methods and value of eradication, went on with it and, moreover, those around also took it up. Once they got the farming community to realise just what could be done, it became a very much easier matter to put any scheme into operation.

That brought him to what had been done abroad in regard to the eradication of contagious abortion. In the United States of America, abortion eradication was progressing well. They had, of course, to help them the confidence inspired by the success of their scheme for the eradication of tuberculosis, and also slaughtering with compensation. Germany now had a voluntary State eradication scheme which was progressing well. Live vaccine had been used at one time on a greater scale in Germany than anywhere else and reports were at first favourable. It had, however, now been dropped in favour of eradication and the use of live vaccine was prohibited except in heavily infected herds. One report published last year showed that in the province of Hanover some 4,000 herds were under control. Within two years, over 2,000 herds had passed two clean tests, over 1,000 had passed four clean tests and nearly 500 had passed five clean tests. That went to show that abortion eradication was a practicable proposition because the scheme was voluntary and no financial help was given other than free testing and advice.

Norway started an eradication scheme some few years ago. During 1935 they tested some 4,000 herds and found 2,610 infected. Their policy was slaughter of reactors with compensation which, of course, did help things very considerably. They carried out a large number of tests during 1935, and in 1936 they reported that only 11 per cent. of the herds originally infected remained. Schemes were also in operation in Denmark and Switzerland.

He came now to the important question of vaccination. For over half the herds in this country, it was impossible to do anything but vaccinate and it was of the utmost importance, therefore, that they should have a satisfactory vaccine—one that would prevent abortion but would not cause permanent infection of an animal. Such a vaccine could be produced, as had been shown by Dr. McEwen himself and by others. He would like to ask Dr. McEwen if he thought that if we had to produce such a vaccine on a large scale, over a period of years, he would feel sure that a vaccine of just the

right virulence could be maintained—because if one had a vaccine that would not produce permanent infection, one might be getting very near a vaccine that would not produce immunity. Cotton and Buck, *e.g.*, in their work had shown that one of their strains, which at one time produced a satisfactory immunity, had entirely lost this property when used in another experiment 21 months later. He agreed with Dr. McEwen that calfhood vaccination appeared very promising and thought that it probably offered the best hope for the future, because the calf was very resistant and, whilst not becoming permanently infected, appeared to retain something which prevented subsequent infection and abortion. There was evidence that it was of considerable value and it was being tested on a very large scale in America at the present time: they were aiming at vaccinating 25,000 animals—they had already done 5,000. He was not quite sure whether any controls were being kept.

As to Dr. McEwen's suggestion that they should take a definite area in this country, close it up, vaccinate all the animals as calves, and await the results, he felt that they might not get a very definite answer and if that was so much time and money would have been wasted. He thought, whether Dr. McEwen's suggestion was adopted or not, that an attempt should be made in this country to try out calfhood vaccination on a sufficiently large scale with proper controls. He was aware of the difficulties to be met with but submitted that a reliable answer was much more likely.

He would like to ask Dr. McEwen if he had any idea what was the nature of the factor which was responsible for the immunity which persisted from calfhood vaccination. Had allergic tests been carried out in calves? Did he think that that immunity had any connection with the apparent immunity possessed by cows which remained in a herd where infection was rife, for many years and yet did not become infected? Did they have a natural immunity of the same nature, or did they become mildly infected at some time or other—develop a transient agglutination reaction and lose that, but retain whatever it was that accounted for the immunity given by calfhood vaccination? Did he think there was any connection between the results of calfhood vaccination and the practice adopted (they said successfully) by some owners of putting the calves on the cows which aborted?

Again he thought Dr. McEwen must have had experience of herds where there was a very high percentage of recently infected cows and very few abortions. He had in mind a group of three farms with some 300 head of cattle. The clean cattle were kept on two of these and the reactors sent to the third. They had sent nearly 50 reactors there in the last few years and the owners had told them beforehand that they would get few abortions there. They proved to be right. Many of these animals were recently infected and he felt sure, as did the owners, that had these animals been left on either of the other two farms many would have aborted. He would like to ask Dr. McEwen what he thought that factor might be. There did seem to be something in the nutritive properties or the soil of certain farms which appeared to prevent actual abortion.

Dr. McEwen had said that pregnant animals should not be added to a clean herd. He did not quite understand that. Did not Dr. McEwen believe that pregnant animals could safely be brought on to a clean farm provided they could be isolated until they had calved once—then they were safe.

The President (Dr. J. McCunn) said that, before the general discussion was opened, he must take that opportunity of thanking Dr. McEwen for coming there. One could tell by listening to him that he was a master of his subject and that he had got all the facts at his fingers' ends. (Applause.) Moreover, Dr. McEwen had been very lucky in the choice of his opener, Dr. Stableforth. (Hear, hear.)

Apparently Dr. Stableforth did not quite agree with all that the essayist had said, but that was what they expected. Personally he would have been very disappointed if Dr. Stableforth had been able to agree with Dr. McEwen in every detail.

From what he could see, as an outside observer, the eradication of contagious abortion largely depended on the question of cost; was it worth the expense. As in all things in the farming world, the cost came back on the producer, and judging by statements in the bankruptcy columns in the papers, and also by the "wills" column, it appeared to him that British farmers were skating all the time on the verge of insolvency; therefore, to his mind, unless some State aid were forthcoming, no eradication could occur. On the other hand, State aid meant a further burden on the back of the taxpayer. It was questionable whether it was worth while for the taxpayer to spend money in eradication. He hoped that this question would be considered in their debate.

Between the years 1920 and 1926, he had some considerable experience of abortion. In the district in which he was then living, and which included a farm run by his brother, abortion was very prevalent. Infection was so extensive that the milk industry at their place and at the farms of his clients around was in a condition of chaos. It was at about that time that the Ministry issued their live vaccine. He believed that his brother and he were amongst the first people to try it. They used it on their own herd. The results were remarkable. It was quite a commercial proposition. After its success on their own farm its use was extended to others around. The success was repeated—order came out of chaos. After a period of time the condition known as "turning" or not holding to the bull appeared: whether that was due to the live vaccine or not, he did not know.

If Dr. McEwen, Dr. Stableforth, or any one else could produce some effective commercially practicable remedy for abortion, he thought they

would have done an inestimable service to the country—a benefit equally as great as, if not greater than, any aid would be in the prevention or eradication of bovine tuberculosis.

That night they had present quite an august company. They had with them some practitioners who had come at his invitation; they were attending "refresher" courses at the Royal Veterinary College and on the Fellows' behalf he heartily invited them to take part in the general discussion, which he now declared open.

Captain J. C. Coleman, having thanked Dr. McEwen for the very interesting paper he had given them, said that he certainly had hoped to have heard of some great advance having been made, but he was sorry to say that, very early in the address, that hope was dissipated, as he found that, according to the essayist, and according to knowledge generally, very little advance had been made in the last ten years in the solution of the problem presented by contagious abortion.

Dr. McEwen had given, as a remedy, the getting rid of disease by segregating the reactors. That appeared to him to be rather unsatisfactory, because the essayist had said later that the agglutination test was not always reliable, and that if by chance one had left in a herd a reactor that had not responded to the agglutination test, it probably would do so when it calved.

He had been particularly interested lately in the references made by medical men to undulant fever, and he would like to ask Dr. McEwen what relationship there was between *Brucella abortus* and *Brucella melitensis*, whether they were just one and the same organism and whether undulant fever could be contracted from drinking milk from cows affected with contagious abortion.

Quite recently they had been subjected to a fresh alarm by Mr. Scorgie and Dr. Stableforth in the *Veterinary Record*. He had a herd which he thought had the disease described by them: the herd was absolutely sterile.

With regard to vaccination, Dr. McEwen had heard him speak of this on previous occasions, *i.e.*, that he had a great deal of faith in the dead vaccine and had used Nator B with very great success. About four years ago he had a breakdown in two large herds and was much alarmed. He sent material to the Laigle laboratories, Paris, who forwarded him some vaccine made from this material, in which a new organism had been found which was capable of causing contagious abortion, asking him to use it with stock Nator B. He had used it so, with very great success.

He had three small herds which had had a considerable amount of abortion in them and they gave a reaction to the agglutination tests. They aborted three weeks before their time. He had used Nator B in those herds for 18 months and there had been no further cases of abortion.

Mr. G. P. Male, after thanking Dr. McEwen for his paper, said that the essayist had reminded them that the cream had not been skimmed off that subject and that there was still a great deal more work that wanted doing: he (Mr. Male) had been urging that for many years.

Like Professor McCunn he had carried out some very early experiments. They came to the conclusion then that the live vaccine was successful. They had controls and the percentage of abortions was very much higher in the controls than in those which were vaccinated.

He was rather disappointed in one thing—and only one—and that was that Dr. McEwen had not told them more about his own experiments. One of his main reasons for coming there that night was to congratulate Dr. McEwen upon his splendid work, which he thought would lead to very great improvement and might mean eventually immunising a very large proportion of the cows in this country. (Hear, hear.)

There were two great methods of tackling that problem and they had heard that night some who advocated the segregation method and others who preferred vaccination. Even Dr. Stableforth had told them that in 60 per cent. of herds in this country it was impossible to carry out the method of isolation. With the Attested Herd Scheme and the task of producing a herd which was tubercle free and maintaining it so, the difficulties were so great that to have to sacrifice cows which were affected with contagious abortion would create an impossible position, and the difficulty would increase as the attested herds increased. It was difficult enough to rear herds which were free from tuberculosis, but to get them free from contagious abortion at the same time was quite impossible at present, so that they should welcome a vaccine, and the objections to the live vaccine were not as serious as was usually made out. He had seen 95 per cent. of cows abort in a herd of 140 animals in one year, and in such a case as that to attempt to segregate or to sell off, as the isolationists advised them—[Voices: "No."]—eliminate them from the herd, to put it in a nicer way—(laughter)—was absurd. They would probably never get compensation in this country, so that if they were going to eliminate those cows they would either have to slaughter them or send them into a market, which was against the law and morally wrong—or what *were* they to do with them? If one had the necessary buildings and grass land to isolate the affected animals and test them frequently this should be advised but unfortunately the agglutination test was not always right. It was all very well to test the cows every two months and then to sell off periodically the persistent reactors but they might have no animals left: they might, of course, say that by that method they had eradicated the disease—well, they had. (Laughter.) It would spread it all over the country, and that was one of the great objections he had to the isolation method.

As they all knew, throughout the country districts there were people going round with wonderful remedies: you gave one dose of medicine and the cow would not abort. Some years ago he analysed one of these remedies: a charge of £1 a dose was made, and all it contained was treacle, colouring matter and a little bran. After the analysis was made that particular preparation gradually disappeared from the market. Other firms were manufacturing other preparations now. It really was necessary that they should have something to combat all those quack remedies.

He would like to ask if Dr. McEwen had any statistical information as to how long an infected cow might be expected to react to the agglutination test, and, if she went on reacting, if she was necessarily to be regarded as a dangerous animal. It might be that such a reacting cow, although (or because) she had been injected, nevertheless possessed a high degree of immunity, and if they were going to eliminate cows such as that from the herd they might be eliminating animals with a great degree of resistance. In some experiments that were made after injection

with the Ministry's vaccine, in the majority of cows reaction to the agglutination test ceased in from a few days to a few weeks; but the great objection that was raised to the use of the live vaccine was that cows were infected animals, and that their milk was infective. If, however, the disease was rife in a herd, it surely did not matter if you had a few more bacilli that, moreover, were attenuated and if you could get live calves by using the vaccine. He did not see that there was any great objection, and he was exceedingly pleased that Dr. McEwen was going on with his good work.

Mr. G. H. K. Peace said that, following upon Mr. Male's remarks on "quack" remedies, he thought he was on to a good thing the other day when he was presented with a large bottle. He had since ascertained that the price was £4 15s. 0d. for the bottle (which contained sufficient for treatment of ten cows for one year —giving four doses each). There was a guarantee that if a cow aborted after two doses the makers would refund £2 10s. 0d. as a form of insurance. He, too, had this particular remedy analysed and he found that it was a solution of methylene blue. He had been wondering ever since whether or not anything of value could be done in the field of chemotherapy.

Dr. R. F. Montgomerie observed that he did have an opportunity of doing some work on contagious abortion, but that he was not possessed of the pertinacity and the expectation of long life of which Dr. McEwen and Dr. Stableforth were obviously possessed. (Laughter.) Moreover, when he got his teeth into the subject he came to realise how very difficult it really was; it was, indeed, he should imagine, about the most difficult problem which one could attack, both because one had to wait very long for the results and because it was very difficult to interpret some of the results which one did get.

He was a little surprised that Dr. McEwen made somewhat light of contagious abortion in this country and that he had said that, as far as he was concerned, he would much prefer to attempt the eradication of that disease than of bovine tuberculosis. His (Dr. Montgomerie's) view was the reverse, provided that one was given a potent tuberculin to work with.

The question of eradication must, of course, be considered in this country, despite the fact that even Dr. Stableforth had said that 60 per cent. of the herds were unsuitable; he would put the proportion unsuitable very much higher. He could recall quite a number of instances where the testing and segregation method was put into operation. In particular he recalled two farms where the circumstances were almost identical, but where, while success was achieved on one farm, there was abject failure on the other. He knew of no basis on which to give an early opinion as to whether segregation would be successful or not. Even if building conditions were suitable, pasturage ample, and the proportion of reactors to the first test small, one could not say then that the application of the policy of segregation would lead to eradication. He would never permit the farmer to believe at that stage that by following instructions success would certainly follow. Not until the herd had been tested twice or three times at monthly intervals could one be reasonably confident of the outcome of the attempted eradication. A very important factor was the opportunity for the recent spread of the disease and this was very difficult to gauge. A herd agglutination test immediately following one or two abortions really gave them no guide whatsoever. That was, he supposed, the reason why Dr. McEwen and Dr. Stableforth recommended that there should not be a disposal of reactors immediately after the first agglutination test. They too, had no confidence in success until the true state of the herd was known by two or three monthly tests. He agreed that the farmer should not immediately sell those animals which reacted to the first agglutination test, because in a short time it might be found that eradication was quite impossible.

The mass of quack remedies sold as preventing contagious abortion had been mentioned, and one knew that one in particular was at the moment being very widely sold. He could not help but think that these remedies got the testimonials they did simply because they were used under conditions in which it would be impossible to get anything but apparently successful result, *i.e.*, they were used in herds in which a large number of animals had already aborted and in which, even with the injection of clean cold water, one would expect a great reduction in the abortion rate in the following years. They had, therefore, to be very careful that they did not give a "testimonial" to vaccination which was based on very similar fallacious grounds. He rather thought that the Ministry of Agriculture missed a glorious opportunity, and had been missing it for many years, in connection with vaccination. First of all, they had no set conditions in their trial of live vaccination to get any real results, and secondly, that in the years following the early period of trial they made little effort to collect results and give them any statistical data. A further point that he would like to make was that, so far as he was aware, there had been no record of the strains which had been used in that process of vaccination. Dr. McEwen had mentioned the question of the rough strain of *Brucella abortus*: he would like to know if that strain would keep its characters.

The question of vaccines intrigued one very much. At the Llandudno Conference the fact was emphasised that young animals could not be infected with *Brucella abortus*; he remembered asking, if that was so, then why was calf-hood vaccination not a country-wide process? He had had a limited experience of this type of vaccination. Those calves vaccinated at least three months before they were due for service, calved down quite normally, but some of them carried agglutination titres of even 1: 80. It was very difficult to decide whether they were animals which should be allowed into a clean herd or not. However, generally speaking, if one followed the course of contagious abortion in an infected herd where practically nothing was done, the disease ran its course and the heifers coming in could stand in the herd without abortion. One had often wondered whether that was due to some natural calf-hood "vaccination."

Dr. Stableforth had rightly emphasised the need for sufficient fields. In one instance they set off on an eradication scheme believing that they had plenty of pasture accommodation, but they had seen one pasture after another become infected, until in the end they hardly knew where to turn out the clean section of the herd.

Mr. T. J. Bosworth, having expressed the pleasure afforded him by being able to be present, if only as a visitor, at a meeting of the Society of which he had for a number of years been a member, said that he had been

very interested to hear Dr. McEwen and Dr. Stableforth voicing their views on that very important subject of contagious abortion. He personally agreed with Dr. Stableforth that it was perhaps the most serious disease of cattle in this country with which they had to contend. He thought that although it was true, as had been stated, that anyone working on a particular subject was apt to give an exaggerated importance to it, that would only happen if he stuck to his laboratory and did not go out into the field. He would not have to go far to realise the serious effects of contagious abortion.

In regard to the question of eradication, he found that Dr. Montgomerie had almost exactly expressed his own point of view, arrived at as the result of his own experience. The laboratory with which he was associated had not found it quite so easy to control infection in herds, in which at first sight it appeared worth while to make the attempt, as might be supposed from the success which Dr. Stableforth had had in this direction. Dr. Stableforth had mentioned one point with which he was not quite in agreement, and that was the matter of the building accommodation on the farms. Personally he thought that buildings had an importance which it was easy to under-estimate because on many of the farms in this country the buildings were such that it was impossible to carry out adequate disinfection, which seemed to be quite an essential part of trying to clear up contagious abortion in herds of cattle.

On the question of vaccination, he was very pleased indeed to find, on reading Dr. McEwen's recent article in the *Veterinary Record*, that he was persevering with that question. Although he had been obliged to work under difficulties in not being able to secure as large a number of control animals for his experiments as he would, no doubt, have wished, his results did appear to suggest that his method was worthy of an extended trial.

Professor G. H. Wooldridge said that he, too, had been very interested in the discussion and particularly in the hope that had been aroused in their breasts—at any rate by Dr. McEwen—in respect of the vaccine that was likely to become available and perhaps that was likely to be altogether free from the objections which were felt to be associated with the live vaccine that had been in use for so long.

He thought he disagreed with Dr. McEwen when he suggested that contagious abortion was not such a serious matter as compared with some other affections: he imagined that at that stage in the discussion the essayist must feel a little isolated in that view.

Last year he had the privilege of attending the World's Dairy Congress in Berlin, where this subject was discussed, and the general impression, as stated by a resolution adopted by the Congress, was that the damage following contagious abortion was enormous and merited the attention of the Governments of the various countries directly. They passed a resolution recommending that the disease be dealt with as a matter of urgency, and that resolution had been adopted in this country by the British Dairy Farmers' Union and had been transmitted by them to the Ministry in the hope that they might be persuaded to undertake a national campaign against the disease.

Losses from contagious abortion were not only to be accounted for by the loss of calves but by the reduction in the milk yield and general loss in condition of the affected cattle. It was also suggested that the disease interfered with beef production, while some stress was laid on the danger to human beings from the consumption of infected milk.

With regard to the use of vaccination, the general opinion at the Congress, with one exception only, was that the live vaccine should not be used. The exception was made by Professor Veenbas, who limited that recommendation to those circumstances which obtained in this country, where he (the speaker) thought it was more commonly recommended, namely, to those herds in which the disease was rife—and then its use to be limited to young stock in the hope that they would have an immunity conferred upon them and would not abort in after years.

That opinion was also associated, without any hesitation, with the opinion that dead vaccines were absolutely useless: that was the concensus of the opinion of all the institutions represented at the Congress.

The main points of the other recommendation in regard to the control of the disease were first of all, the diagnosis by means of the agglutination test, which they regarded as being very definitely reliable, and secondly, that elimination from the herd was to be carried out, but that was to follow a period of isolation and re-testing, and then reacting animals must be slaughtered—in no circumstances would they recommend the disposal of reactors to carry the danger to other herds.

One other point they stressed very strongly was the necessity for calving boxes. They emphasised that all animals, normal or otherwise, should calve in such boxes and that they should remain there until they had passed the agglutination test: only by that means did they believe that the rest of the herd could be kept clean. It was understood that in a number of instances cows might fail to react prior to calving and yet, after calving, they were found to be positive reactors. In a way the recommended use of calving boxes rather contradicted what he used to teach years ago, when he said that calving boxes were the source of considerable trouble in the way of navel infection and enteritis. They were, as then used, because disinfection was not carried out, but if that system were to be adopted now, disinfection must be one of the main planks of the whole procedure.

In regard to chemotherapy, it was reported at the Congress, by numerous workers, that they had consistently tested a large range of chemical agents which were reported to be effective, including aniline dyes (which had been referred to that evening) and in every single instance they had proved their inefficiency. So that, at the present time, there was no known remedy that was of the slightest value. It would be interesting to await developments regarding the use of sulphonilamide.

Mr. W. H. Dennett, having observed that as a visitor there that evening he would like to say what great pleasure it gave him to be present, mentioned the possibility of certain so-called remedies for contagious abortion interfering with the proper reading of the agglutination test. Mr. Dennett instanced experiences he had had in this connection. If (he said) there was any preparation that would prevent a proper reaction to that test in even a small percentage of cases, it was highly dangerous, and he would like to ask Dr. McEwen if he had any knowledge

of anything of the sort, and if so, what he had to say about it.

Veterinary Lieut.-Colonel G. Rees-Mogg stated that Dr. McEwen had been very kind to him years ago when he was foolish enough to start a pedigree Friesian herd, and he owed him a debt of gratitude for what he did for him 14 or 15 years ago.

As to financial loss from contagious abortion, perhaps he had been exceptionally unlucky, but he thought that contagious abortion caused greater loss than all other bovine diseases put together. He started when cattle were very dear and he had very bad luck to commence with. He found that many animals that had contagious abortion got mastitis at the same time.

Mr. Male had said that he knew of one herd where 95 animals aborted out of 150: just think if that man had a milk contract and had to buy 95 animals to fulfil it. In his (the speaker's) case, with his herd of British Friesians, he had some good blood and did not want to get rid of the affected animals, and some of his animals aborted three times. He had listened to many papers about contagious abortion, both in company with Professor Wooldridge in Berlin and in New York. In America and Canada they were much more rigid about contagious abortion than was the case in this country. They had their herds which were free both from contagious abortion and tuberculosis, and he hoped that some day the same could be said of the British Isles.

He had never tried vaccination: they were told that if they vaccinated with the live vaccine they would sometimes get sterility; also they were bringing the disease into the herd. As to the dead vaccine, he thought it was a fact well known amongst all veterinarians that it was absolutely useless.

In quite 90 per cent, of farms isolation was impossible. The ideal thing was to breed your own animals and not buy them—if they did buy, however, let them take a tip from him, for he had been let down badly over this—have them tested twice with an interval of three weeks before putting the animals into the herd.

Ponds, he thought, were a great source of infection, not only of contagious abortion, but of Johne's and other diseases. The majority of the animals only aborted once, but for how long were they infectious? That was a most important question. He desired to thank Dr. McEwen for a most interesting paper, dealing with a disease which he, personally, thought was more important than any other from the farmer's point of view.

Mr. J. F. D. Tutt thought that Dr. McEwen must by now realise that he was rather rash in stating that contagious abortion was not of great economic importance, and he could only conclude that the County of the White Horse was more immune to the disease than other counties. He agreed with what Mr. Male had said; and he was of the opinion that the quickest way to eradicate the disease was by frequent blood testing and the elimination of reactors. In his opinion live vaccines were the only ones to use. He had had no success with dead vaccines except in one instance where he had used a formalin killed vaccine made by Dr. Sheather.

He disagreed with the alleged risk of undulant fever in the human subject arising from the consumption of milk from cows inoculated with living vaccine. Surely, the risk, if any, was greater in cattle naturally infected.

Mr. R. D. Callaghan commented that, in his part of Lincolnshire, isolation was impossible. Therefore, he had been more concerned with vaccination. He had tried all the vaccines available but he had been very disappointed. They had heard quite a lot about the disadvantages of using the live vaccine—with regard to the human point of view, etc.: he was speaking now as a family man as well as a veterinary surgeon, and he would suggest that the true solution of that aspect of the problem was pasteurisation.

In 1919 he assisted his late uncle in the use of a live vaccine: they got marvellous results in some cases; in others the results were most disappointing. Another matter that had to be borne in mind was the fact that sterility seemed to be definitely very much bound up with the question of abortion, and one did find with regard to vaccination of heifers that with a live bacillus sterility would result in from 50 to 75 per cent. of cases. There was, of course, quite a number of so-called remedies, some of which had been mentioned that evening, but so far no one had made reference to the billy-goat. (Laughter.)

The Reply

Dr. McEwen thanked the meeting for the stimulating reception they had given him, which was a great encouragement to him to continue with his work. Apparently he had conveyed the impression that he did not regard contagious abortion as a very serious disease. This was not really the case as he considered it one of the most, if not the most serious disease of cattle in this country; if he had not regarded it as serious he would not have spent the greater part of his time during the past few years in working on contagious abortion. It was, however, often depressing to encounter the apathy of farmers to the control of the disease in their herds. Many farmers were enthusiastic at the beginning of a plan of control but had not the persistence to follow it consistently for months or years and their enthusiasm soon faded out, especially when they were called upon to pay a modest fee to their veterinary surgeon.

He agreed with Dr. Stableforth that the disease might be costly but it was not necessarily an expensive disease to control and he mentioned a short paper by him that had appeared in the April number of the *Journal of the Ministry of Agriculture** in which it was shown that the losses sustained by the sale of reacting animals attributable to the eradication plan, which had been successfully followed for a period of six years in a large self-contained dairy herd, amounted to approximately £40; whereas the much greater sum of £651 was lost through the sale of reacting animals owing to disease or undesirable qualities not connected with the control of contagious abortion and which would have occurred had control not been attempted. This greater sum represented the losses in a section of the herd only, whereas for £40 abortion had been controlled in the whole herd.

Continuing, Dr. McEwen said that his results on the control of the disease by isolation of reacting animals had been good where control

*This paper is reproduced later in this issue. —*Editor.*

measures had been properly carried out, and were in agreement with Dr. Stableforth's experiences. Breakdowns had occurred in some instances but these could be traced to definite causes and had generally been brought about through negligence at the farm, the tested stock having been allowed to come into contact with infected animals. Unfortunately the control plan not infrequently broke down because the owner or the cowman had not the persistence to adhere to it and if the cattle were calving normally they got careless with testing and isolation. He agreed with Dr. Stableforth that abortion was frequently relatively easy to control; this was indicated by the information given them by Dr. Stableforth concerning its control on the Continent of Europe and in the United States of America. Dr. McEwen then quoted the latest figures from the United States which showed that during the past year 802,000 herds had been tested with a view to the control of the disease and that they had tested eight million animals. He believed that in the U.S.A. they were approaching an enormous task with courage and with a considerable amount of success. In his opinion, however, the success of any eradication plan was almost entirely dependent upon the management at the farm. It was upon the enlightened efforts and co-operation of those who were actually managing the stock that the success of eradication rested.

With regard to the percentage of pregnancies terminating in abortion, from his own observations in the South-Eastern Counties it appeared that about 15 per cent. of pregnancies were known to terminate in abortions. This figure, he realised, was lower than that given by many authorities. However, if more than 15 per cent. of all pregnancies terminated in abortion he felt that the effects of the disease would be more marked and that farmers would show greater persistence in trying to control it. Sometimes he felt that it was a pity every infected cow did not abort and continue to abort, for if this were the case control measures would very quickly be effectively applied. Quite an appreciable number of abortions, approximately one-third, were due to some cause other than Brucella infection and at the South-Eastern Agricultural College among other causes of abortion they had incriminated *V. foetus,* streptococci, coliform bacilli, *B. necrophorus, B. welchii* and a mould. Fortunately, with the exception of those caused by *V. foetus,* the abortions appeared to be sporadic and showed little or no tendency to spread.

Referring to the question raised by Dr. Montgomerie regarding the disposal of reacting cows from tested herds, Dr. McEwen said that he fully agreed that one should not advise a man to sell his reacting cattle after one or two tests. He would not feel reasonably sure the disease was under control until the herd had passed three consecutive herd tests, no reacting animal having appeared in the meantime at the after calving tests. When the disease was effectively controlled sales might safely be contemplated.

Proceeding, he agreed that before one could hope to have an extensive effort made to control an endemic disease like abortion public opinion must be educated in favour of that control. But before this could be done there must be a unified veterinary opinion. This was apparently more difficult to obtain in Britain than on the Continent or in the U.S.A. We were more individualistic in our opinions but he thought that to obtain the effective control of any contagious disease we must be prepared to forgo the expression of our particular individual views, at least to farmers and the public, and submit to some regimentation of opinion and to common action. Nevertheless, independence of expression and action must not be given up until common objectives and methods were shown to be really worth while pursuing.

Turning now to the question of vaccination, Dr. McEwen said that vaccination which did not cause infection might be used as a prelude to eradication in infected herds. He had found it possible in one or two vaccinated herds, where the spread of the disease had evidently been controlled, eventually to dispose of the remaining known infected animals and to cease vaccination. In time the agglutination reaction caused by the vaccination tended to fade out and by a careful consideration of an animal's history and reactions to the agglutination test it was possible to say with considerable accuracy whether the reaction was due to vaccination or to a natural infection. In reply to the question regarding the loss of immunising properties which might occur in a given strain of *Br. abortus* through keeping and subcultivation, he had found *Br. abortus* to be a remarkably stable micro-organism which seldom lost its virulence even when kept on ordinary bacteriological media, and he thought that with special methods of preservation it might remain unchanged indefinitely. Furthermore, their work had shown that a strain possessing little or no virulence could, by appropriate animal passage, be progressively increased in virulence. He felt therefore that it was not beyond the possibility of bacteriology to exercise control over virulence and to keep strains in an unchanged state for very considerable lengths of time.

Although, in the experiments by Cotton and his co-workers on the comparison of non-virulent strains with those of reduced virulence and of full virulence, the non-virulent strain had given less definite results than the others, he felt that the scales had been rather weighted against success with the non-virulent strains, as immunity was tested long after the single inoculation of vaccine and in the case of the non-virulent strain this had probably disappeared from the body long before the strains possessing some virulence were eliminated.

It was quite apparent that with a non-virulent vaccine many matters regarding dosage, the interval between doses, and the route by which vaccination was made, etc., would have to be tested. In B C G vaccination the intravenous route had been found to give better results than the subcutaneous; he did not know the reason why better results were obtained by intravenous inoculation, but it might be connected with a more general stimulation of the reticulo-endothelial system, and it was probable that under certain conditions intravenous vaccination might be useful in abortion immunisation. As regards the different opinions on the use of live vaccine it was probable that these would continue as long as individual herds were dealt with, and that was why he would like to see vaccination systematically followed in an area as suggested in the paper. He agreed with Dr. Montgomerie that if by vaccination one could immunise young stock then the logical procedure would be to vaccinate all young stock in the country; at first, however, he would be content

to experiment on an area containing about 40,000 cattle. Concerning Dr. Stableforth's question regarding the type of immunity which was developed in calfhood and persisted into later life he could give no information. It was but another problem awaiting solution. As to why some cows affected with *Br. abortus* never aborted when moved to certain land, whereas others that became infected along with them but were not moved on to that land aborted, he could offer no explanation, but it would be rather surprising if susceptibility to abortion were found to depend on some nutritional factor. The circumstances recorded by Dr. Stableforth apparently ruled out any possibility of differences in virulence of strains as presumably all the cattle were affected with the same strain or strains. Some people thought that variations in the virulence of strains of Brucella might account for the differences in the epidemiology of the disease on different farms. He knew of no evidence that field strains of *Br. abortus* varied in virulence. As far as their own work went it showed that it would be extremely difficult to demonstrate degrees of virulence in freshly isolated field strains.

One thing he should like to make clear was that when he said no purchased pregnant animal should be introduced into a clean herd he meant it; after calving and passing the test the animal might be introduced into the herd, but prior to that she must be kept isolated.

He was afraid that he must have given Mr. Coleman a wrong impression about the work of the past ten years. Important advances had been made during that time regarding vaccination. The use of vaccines of reduced virulence and calfhood vaccination were practically confined to the past ten years.

The suggestion that segregation was not satisfactory because reliance could not be placed on the result of the agglutination test had to be qualified. He thought the test was extraordinarily reliable after an animal had calved, and when the limitations of the test were recognised and safeguarded against, segregation was satisfactory.

The important relationship between undulant fever and *Br. abortus* and *Br. melitensis* was that both bacteria might give rise to undulant fever in man. Undulant fever in this country frequently appeared to be of a very mild type and fortunately was not very common. He thought that not a little excitement, probably more than the facts warranted, had been caused by the knowledge that undulant fever occurred in this country. This no doubt had given rise to the order forbidding the use of live vaccine in tuberculin tested herds licensed by the Ministry of Health. It had not been shown that in heavily infected herds the use of living vaccine increased the percentage of animals eliminating *Br. abortus* in their milk; what evidence there was rather pointed in the opposite direction. He had approached the Ministry of Health and asked for permission to use a non-virulent vaccine, that had been shown not to infect the udder, in an endeavour to protect the non-reacting animals in a heavily infected herd licensed to sell tuberculin tested milk, but permission had been refused.

He had not any personal experience of trichomonas infection but it was a fact that trichomonas did cause abortion at a very early stage of pregnancy; furthermore, it gave rise to metritis and to sterility and the infection could be transmitted by the bull. As regards the use of dead vaccines the experiences given by others had, to a great extent, answered the question. When dead vaccine had been used in critical experiments it had never been shown to be of real value. Of course when it was a case of doing something in a herd that had become naturally immune to abortion that "something" was bound to receive credit that it did not deserve.

Mr. Male had referred to the Attested Herd Scheme and to the difficulties of trying to control abortion when you were also struggling with tuberculosis control. He agreed very largely with Mr. Male's observations and that was why he thought it most desirable to find a safe and effective method of vaccination in order to protect valuable tuberculosis-free animals against abortion infection from cattle that the owner could afford neither to isolate nor to sell. Mr. Male had mentioned a herd where it took ten years to eradicate contagious abortion. He felt this was an unnecessarily long period and where isolation was effective a period of two to three years should be sufficient for the elimination of all infected stock from the clean section of the herd.

As to the length of time animals might react to the agglutination test, this was variable but some animals reacted for the rest of their lives, and would have to be regarded as potentially dangerous animals which could not be introduced into clean herds. They were, of course, often satisfactory breeders.

Live vaccines which caused permanent infection were objectionable but if a live vaccine did not infect, the objections disappeared. He had already referred to the possibility of vaccination forming a prelude to the eradication policy in herds which were primarily heavily infected.

In reply to Mr. Peace, he thought it was a very sound scheme to undertake insurance against contagious abortion. Taking the country all over he thought that probably not more than 15 per cent. of all pregnancies terminated in abortion and a proportion of these were not due to Brucella infection. Therefore, where any particular "cure" was backed by an insurance against abortion caused by Brucella it was a sound business proposition provided sufficient was charged for the "cure," the more especially if the "cure" cost little enough in the first instance. (Laughter.)

He had forgotten to mention the work with prontosil, recorded by Dr. Montgomerie in the *Veterinary Record* a week or so previously. Dr. Montgomerie found that treatment cured some heavily infected laboratory animals. This work, therefore, opened out prospects of great possibilities. It would be extremely helpful if it were found that the disease in cattle could be cured by chemotherapeutic means and he hoped that Dr. Montgomerie would go on and prosper with his investigations.

He agreed with Dr. Montgomerie that the Ministry of Agriculture had not taken full advantage of opportunities to study the effects of vaccination. Their vaccine had been issued at the rate of 25 to 30 thousand doses per annum for very many years and yet no more was known about it than when Sir Stewart Stockman published his results in 1914.

Just one word about calfhood vaccination: there were limits to its value. If calfhood vaccination were successful in preventing infec-

tion it would have to be universally practised, otherwise where a farmer purchased a heifer or cow he would never know whether it was a protected animal or not. It would, of course, be all right in the case of the man who kept his own calves and did not buy in. He did not know whether calves and heifers, the progeny of infected cows, were more resistant to infection than animals which had never been in contact with infection but some time ago Schroeder had produced evidence to show that they were neither more nor less resistant than animals born and reared away from infection. He thought he had already touched on most of the points raised by Mr. Bosworth.

He fully agreed with the remarks made regarding the loss of milk in infected animals.

Mr. Dennett had described how after the use of an alleged cure the animals ceased to react to the agglutination test, apparently because the "cure" had interfered with their ability to produce agglutinins. He could not conceive of anything which could so affect the body cells that they were incapable of antibody production. On the other hand, if the alleged cure had actually got rid of the infection then it was possible that in time the agglutinins would disappear and if this had happened it was interesting and exciting. Unfortunately what Mr. Dennett had described might be due to differences in the interpretation of the test by different laboratories, which showed that it was necessary to have a standard method of testing and reporting on the test.

Concerning ponds as a source of infection, a matter raised by Colonel Rees Mogg, they very well might be as far as contagious abortion was concerned. *Br. abortus* was able to live a remarkably long time when kept at the laboratory in water. He did not think the pond of much danger in Johne's disease in so far as it was extremely difficult to infect anything but young calves with Johne's disease and calves would seldom have access to ponds. With abortion it was different as adults were susceptible.

How long were animals infective after abortion? The uterus was infective for a comparatively short time—three to four weeks; during this time Brucella might be eliminated in the discharges. Infected animals were, however, never safe animals irrespective of the condition of the uterus. They were dangerous because infection might be disseminated in their milk and it was possible for other animals to be infected by the hands of the milker or by the cups of the milking machine.

As regards Mr. Tutt's experience with formalinised vaccine, he had not made any observations on cattle but in comparative tests on laboratory animals formalinised vaccine had been less successful than a living non-virulent vaccine.

One speaker had made most illuminating remarks on vaccination in the field when he said that anything might happen, results might be good or bad. He was wise in remembering the bad—we all had to be on the guard against being led away by the apparently good.

Many things might cause sterility; it was therefore difficult to exonerate or incriminate live virulent vaccine, but as many cows were not rendered sterile despite vaccination he considered it unlikely that vaccination played a part in causing sterility. The question was, however, one requiring fuller investigation.

The Cost of Controlling Contagious Abortion in a Large Self-Contained Herd*

A. D. McEwen, D.Sc., M.R.C.V.S.,
Veterinary Department, South-Eastern Agricultural College, Wye, Kent

The control of a contagious disease such as contagious abortion or tuberculosis is often regarded as an expensive undertaking, and not a matter that the farmer can afford to attempt without financial assistance or reward. The chief inducement to the eradication of tuberculosis has been, and still is, the enhanced price receivable for milk from tuberculin-tested herds. There is no comparable stimulus to the eradication of contagious abortion, but many farmers are interested in the control of this disease, and some have undertaken its eradication from their herds, while others spend considerable sums of money on vaccination or alleged cures.

If farmers were conversant with a plan for the eradication of contagious abortion, and if the cost of the plan were not prohibitive, it is probable that more of those who are in a position to do so would undertake eradication. The present paper endeavours to give an account of the cost of the control of contagious abortion in a large dairy herd where the circumstances were favourable to eradication, and to illustrate that the cost of following a plan of eradication need not be expensive.

Eradication was started in this herd because the owner decided that it was advisable for him to have abortion-free animals for sale, disappointment having been occasioned by abortions occurring among heifers recently sold from the farm although the number of abortions that had taken place in the herd itself had not reached an alarming figure. Yet a preliminary test carried out on the cows showed that 66 out of a total of 182 gave a positive reaction for contagious abortion and 17 showed a doubtful reaction; the remainder were negative to the test.

Four different dairy groups, each with its respective pastures separated from the others and from neighbouring farms, were used to accommodate the herd. It was decided to place all the infected and doubtful cows in one dairy and to keep non-reacting animals only at the others. Later, however, it was found necessary to keep a number of the non-reactors at the dairy where the infected cows were.

The plan for the control, and it was hoped

*Reprinted from the *Journal of the Ministry of Agriculture*, Vol. 45, No. 1 (April, 1938), pp. 28-37.

eventual eradication of the disease, was simple; if it succeeded it should cost little, but if it failed no financial sacrifice would have been made. It was arranged that blood samples from all non-reacting animals, which were or had been in milk, should be tested at regular intervals. These tests constituted the general herd tests. As a negative reaction in the pregnant cow or heifer cannot always be relied upon as evidence of absence of infection, all non-reacting animals were isolated at calving or at aborting and not returned to the non-reacting portion of the herd until they had passed a test. Herd tests were carried out every two months at the dairies containing only non-reacting animals, until three consecutive herd tests had been passed without any reactor appearing during this time; thereafter the herd tests were made at six-monthly intervals. The non-reactors in the dairy containing infected cows have, since the plan started, remained at two-monthly herd tests because of the danger of infection spreading from the latter. The doubtful reactors were tested regularly and some became positive while others were eventually passed as non-infected. Heifers were tested before or soon after service. It was considered essential to keep the cost of eradication as low as possible, and many of the reacting cows that were valuable animals were not sold off because they reacted to the test for contagious abortion, but were retained and only disposed of when a favourable opportunity involving the minimum of loss presented itself. Many of these animals, however, had to be sold because of disease that had no connection with the plans for the control of contagious abortion.

The policy was the eventual elimination of reacting animals without undue sacrifice.

As the abortion-reacting animals were sold so it became necessary for the economic working of the dairy where they were kept to introduce non-infected animals to maintain the numbers, and with the passage of time the number of infected stock diminished, while that of the non-infected increased. The reacting and non-reacting groups, though in the same milking shed and attended by the same men, were kept apart as far as possible and grazed on different pastures. The keeping of infected and non-infected animals in close proximity to one another is to be avoided where possible, but unless accommodation is exceptionally abundant it may not be practicable during certain phases of the eradication of the disease. On the farm in question it has worked well, there being no evidence of the disease having spread from the reactors to the non-reacting cows, although there is the possibility that one young animal became infected from the reactors. The first herd test that showed the presence of 66 reacting animals was made in November and December, 1931. Between that test and May, 1933, 18 more cows became positive reactors, but since then and until the herd was sold in October, 1937, only one fresh reactor appeared in the entire herd. This was a young heifer that probably became infected through drinking milk from infected cows. The breeding histories of the non-reacting animals have been satisfactory, there being practically no sterility, and out of 710 pregnancies 698 ended normally. In three instances the foetuses were fully formed but dead, and two premature but living calves were born. Only seven pregnancies ended in abortion. Therefore, 98 per cent. of all pregnancies ended normally, which is satisfactory. It should be noted that none of the abortions was caused by infection with *Br. abortus*.

The breeding histories of the reacting animals retained in the herd were not so good, there being 145 pregnancies, 21 of which terminated in abortion and 4 in the delivery of full-time but dead calves; 17 per cent. of the pregnancies, therefore, terminated abnormally.

Table I gives particulars regarding the length of time reacting animals were maintained in the herd after having reacted to the test, and also shows the number of pregnancies each of the animals has had and how these terminated.

Table I

No. of Cow.	Time Kept on Farm after Reacting to Test.	Pregnancies Terminated before Testing		Pregnancies Terminated after Testing	
		Normal.	Abortion.	Normal.	Abortion.
5	19 months	7	0	1D	1
8	16 ,,	7	0	2	0
13	19 ,,	?	0	2	0
15	26 ,,	2	0	1	0
18	16 ,,	4	1	1	1
19	60 ,,	?	0	5	0
22	24 ,,	1	1	1	1
25	15 ,,	?	0	1	0
28	21 ,,	?	0	2	0
29	21 ,,	?	0	2	0
35	40 ,,	?	?	4	0
38	9 ,,	10	0	0	1
40	Still in herd	6	0	4	0
41	60 months	?	1	3	0
42	10 ,,	?	0	1	0
43	10 ,,	?	?	0	1
46	27 ,,	5	1	2	0
76	Still in herd	0	0	3	1
77	21 months	?	0	2	0
82	11 ,,	0	0	2	0
94	Still in herd	?	?	4	2
99	24 months	?	?	1	0
102	24 ,,	?	1	1	0
108	21 ,,	0	0	2	0
109	18 ,,	6	0	1	0
118	66 ,,	?	1	5	0
120	Still in herd	7	0	3	0
122	22 months	1	0	1, 1D	0
128	40 ,,	6	1	3	0
129	14 ,,	1	0	1	1

Table I (*contd.*)

No. of Cow.	Time Kept on Farm after Reacting to Test.	Pregnancies Terminated before Testing Normal.	Abortion.	Pregnancies Terminated after Testing Normal.	Abortion.
130	10 „	?	0	1	0
131	Still in herd	6	1	5, 1D	0
137	18 months	1	0	1	1
138	11 „	7	0	1	0
141	15 „	3	0	1	0
142	7 „	1	0	1	0
145	21 „	3	0	1	0
147	Still in herd	2	0	6	0
148	10 months	2	1	1	0
153	6 „	?	?	0	0
157	25 „	1	0	3	0
176	23 „	2	1	2	0
177	24 „	1	0	0	1
178	23 „	1	0	0	1
179	18 „	0	0	1	1
183	27 „	2	2	2	0
187	40 „	6, 1D	0	2	0
188	10 „	4	2	1	0
189	3 „	4, 1D	0	0	0
190	17 „	3, 2D	0	1	0
191	21 „	5	1	0	1
193	40 „	5	1	3	0
194	11 „	4	0	1	0
197	8 „	4	0	0	0
200	15 „	1	0	1	0
204	4 „	4	1	1	0
205	5 „	6	0	1	0
207	7 „	1	1	0	0
208	18 „	4	0	1	0
209	3 „	4	1	1	0
213	3 „	7	1	1D	0
214	7 „	3	1	1	0
216	4 „	2	0	1	0
217	5 „	1, 2D	2	0	0
219	27 „	3	0	1	0
221	10 „	0	1	1	0
222	11 „	3	0	0	1
225	46 „	1	0	3	0
227	11 „	1	0	0	0
229	31 „	1	0	1	1
230	11 „	0	1	0	0
232	31 „	0	0	2	2
234	22 „	1D	0	1	0
236	16 „	1	0	0	0
237	18 „	0	1	0	1
242	7 „	?	?	0	0
243	27 „	4, 1D	0	1	0
244	24 „	2	0	1	1
245	16 „	1	0	1	0
246	17 „	1	0	1	0
247	23 „	0	0	2	0
248	39 „	0	0	3	1
250	15 „	?	?	?	?
256	7 „	3	1	0	0

Note.—D = calved full time but dead.

No monetary expenses were incurred by the owners of the herd in connection with the testing of blood samples or the bacteriological examination of foetuses or milk samples, beyond those incidental to the despatch of material to the laboratory. The blood samples were always collected from an ear vein, this being a simple procedure and not upsetting or distressing the animals.

In estimating the cost of controlling the disease consideration need only be given to the losses incurred through the sale of animals owing to their being reactors to the test. Reference to Table II shows that most of the animals were sold for reasons quite independent of the eradication plan, and the losses on these animals were in no way attributable to the eradication plan. Some animals were sold after aborting, it being no longer profitable to retain them until another calving, but the losses so sustained are again not attributable to the eradication plan, as the animals would have aborted and would have been sold had the plan not been followed. In some instances the knowledge that an animal was a reactor, when coupled with the appearance of another unsatisfactory characteristic determined in favour of her disposal from the herd. These animals were regarded as having been sold because of two reasons, the eradication plan being one of them and half the loss incurred was debited to the plan.

As already mentioned the aim was to get rid of reacting cows with the minimum of sacrifice, and animals that were breeding normally and otherwise healthy were sold only where favourable opportunities offered. The losses from such sales were not heavy and they were debited to the eradication plan.

At the annual stocktaking valuations were placed on each animal. The difference between the valuation and the price realised when animals were sold was estimated as a profit or loss. At the time of making the valuations the animals that were earmarked for sale for some reason other than their positive reaction to the test for contagious abortion were written down in value; hence the losses from the sale of such animals which were not connected with or attributable to the eradication plan are probably underestimated.

Since the disease was brought under control the surplus non-reacting stock have been sold at an annual herd sale as abortion-tested animals. The holding of these sales was made possible by following the eradication plan, which automatically increased the value of the non-reacting animals. Animals reacting to the test for contagious abortion could not be valued as highly nor sold at such a high figure as non-reactors, but their lower value in comparison with that of the non-reactors cannot be considered as a loss due to the eradication plan.

Table II gives particulars of numbers of animals disposed of for different reasons, their valuation and sale prices, and the estimated loss. In Table III the particulars are summarised.

TABLE II

ANIMALS REACTING TO THE TEST FOR CONTAGIOUS ABORTION.

Losses Due to Causes not connected with the Eradication Plan.

No. of Animals.	Valuation.	Price Realised at Sale.	Loss.
Animals sold because of abortion occurring at a time when it was considered unjustifiable to maintain them until another calving :—			
4	£103 0 0	£32 18 0	£70 2 0
Animals sold because of sterility :—			
6	£135 0 0	£53 0 0	£82 0 0
Animals sold because of mastitis :—			
7	£190 0 0	£55 6 6	£134 13 6
Animals sold because of Johne's disease or wasting :—			
5	£100 10 0	£24 0 0	£76 10 0
Animals sold for unspecified reasons :—			
1	£20 0 0	£6 0 0	£14 0 0
Animals sold because of a positive reaction to the tuberculin test :—			
16	£412 5 0	£262 2 6	£150 2 6
Animals sold because they were poor milkers :—			
2	£36 0 0	£26 0 0	£10 0 0
Animals sold because of two causes affecting their value, *the loss incurred by the sale being divided equally between both causes* :—		Abortion of calf.	Poor milking capacity.
2	£60 0 0	£16 2 6	£21 18 9 £21 18 9
		Sterility.	Poor milking capacity.
1	£35 0 0	£8 10 0	£13 5 0 £13 5 0
		Sterility	Reaction to tuberculin test.
1	£30 0 0	£7 5 0	£11 7 6 £11 7 6
Animals sold because they reacted to the test for contagious abortion and for some additional reason, *the loss being divided between the eradication of the disease and the other reason for disposal* :—		Eradication plan.	Poor milking capacity.
3	£65 0 0	£36 10 0	£14 5 0 £14 5 0
		Eradication plan.	Mastitis
1	£20 0 0	£6 0 0	£7 0 0 £7 0 0
Animals which died or were destroyed on account of old age, and for other reasons :—			
3			

Losses Attributable to the Eradication Plan.

Animals sold because of a reaction to the test for contagious abortion :—			
26	£695 10 0	£686 5 6	£9 4 6
Heifer slaughtered because of a reaction to the test for contagious abortion :—			
Estimated loss			£10 0 0

TABLE III

The figures given in Table II are summarized as follows :

	£ s. d.
Losses due to abortions	92 0 9
,, ,, sterility	106 12 6
,, ,, mastitis	141 13 6
,, ,, Johne's disease and wasting	76 10 0
,, ,, poor milking capacity	59 8 9
,, ,, tuberculin test ...	161 10 0
,, ,, non-specific reasons	14 0 0
	£651 15 6
Total losses caused through the disposal of animals not associated with the eradication of contagious abortion	£651 15 6
Total losses due to the disposal of animals because of their reacting to the agglutination test for contagious abortion and therefore attributable to the eradication plan	£40 9 6

Six of the originally-reacting cows were still on the farm at the end of the period under consideration, having been kept because they were valuable breeding stock. Three of the remaining 78 reacting cows died or were destroyed, but not on account of any specific disease, and they are not shown as occasioning financial loss. The rest of the cows were sold for the reasons shown in Table II and III. The heifer that reacted after May, 1933, was slaughtered for experimental purposes, but had she been sold because of a reaction to the test a loss would have been incurred. This loss has been estimated at £10 and it is shown in the tables. The tables show that the losses sustained by the sale of reacting animals, attributable to the eradication plan, amounted to the small sum of £40 9s. 6d., which represents the cost of effectively controlling the disease in the whole herd for six years.

The much greater sum of £651 15s. 6d. was lost through sale of reacting animals because of disease or other undesirable qualities not connected with the control of contagious abortion, and which would have come about had control not been attempted. It should also be remembered that this larger sum represents the losses from a portion of the herd only, and had the whole herd over a six-year period been considered the losses from disease and the other undesirable qualities would have been much greater.

Contagious abortion is acknowledged to be one of the most important diseases of cattle, and it is probably responsible for greater economic loss to farmers than is tuberculosis. It is, therefore, instructive to find that over a period of nearly six years, during which time the disease has been successfully controlled, the costs of control, which are represented by the losses sustained in selling cows because they reacted to the test, amounted to only a small portion of the losses sustained from tuberculosis in a section of the herd, the herd being self-contained, tuberculin-tested, and licensed by the Ministry of Health to sell tuberculin-tested milk.

The amount saved by the successful control of the disease cannot be estimated as the extent to which infection might have spread had control measures not been enforced is unknown, but it is most probable that further spread would have occurred, the losses from which would have been considerable.

An indication of the extent to which the milk yield may be diminished by abortion is given by the figures in Table IV (overleaf), compiled from the milk yields of 33 cows that had aborted. The complete records of milk yields following abortion are compared in some instances with the complete records of the previous normal lactation, and in other instances with the complete records of the milk yield of the next

TABLE IV

RECORDS OF THE MILK YIELD BEFORE ABORTION COMPARED WITH THE MILK YIELD FOLLOWING ABORTION

No. of Cow.	Lactation before Abortion.				Lactation after Abortion.			Difference in lb. between a Normal Lactation and a Lactation following Abortion.
	No. of Lactations.	No. of Days in Milk.	No. of lb. of Milk.	No. of Months Premature.	No. of Lactations.	No. of Days in Milk.	No. of lb. of Milk.	
5	6th	240	9,510	4½	7th	226	3,682	— 5,828
22	1st	210	5,985	3	2nd	228	5,100	— 885
30	1st	361	8,450	2	2nd	289	4,526	— 3,924
38	1st	357	7,487	3	2nd	242	7,163	— 324
41	1st	294	8,820	?	2nd	249	4,519	— 4,301
43	3rd	333	9,247	1	4th	268	5,189	— 4,058
46	2nd	274	6,632	1¾	3rd	312	5,366	— 1,266
82	1st	189	4,175	4	2nd	276	4,288	+ 113
94	1st	314	5,873	3	2nd	252	4,583	— 1,290
128	4th	304	7,656	?	5th	281	4,999	— 2,657
131	4th	244	6,972	2½	5th	244	6,237	— 735
137	1st	275	5,408	2	2nd	146	2,128	— 3,280
148	1st	344	6,368	2½	2nd	324	5,241	— 1,127
176	1st	360	5,844	2	2nd	234	3,345	— 2,499
177	1st	332	8,549	2¾	2nd	360	6,864	— 1,685
178	1st	284	5,129	1¾	2nd	364	6,454	+ 1,325
179	1st	307	8,247	3	2nd	349	7,224	— 1,023
188	2nd	361	10,180	2½	3rd	250	6,971	— 3,209
191	2nd	362	13,622	1½	3rd	298	7,118	— 6,504
193	1st	297	8,021	2	2nd	269	5,912	— 2,109
204	1st	231	4,105	2	2nd	233	3,802	— 303
209	1st	311	6,781	1	2nd	288	7,037	+ 256
213	1st	360	6,555	?	2nd	341	4,120	— 2,435
218	4th	304	7,656	?	5th	281	4,999	— 2,657
229	1st	347	7,955	½	2nd	327	5,914	— 2,041
244	1st	362	8,187	?	2nd	307	4,269	— 3,918
							TOTAL	— 56,374
							Average	— 2,168

RECORDS OF THE MILK YIELD AFTER ABORTION COMPARED WITH THE MILK YIELD OF THE NEXT NORMAL PREGNANCY

No. of Cow.	Lactation after Abortion.				Next Normal Lactation.			Difference in lb. of Milk between a Normal Lactation and the Lactation following Abortion.
	No. of Months Premature.	No. of Lactation.	No. of Days in Milk.	No. of lb. of Milk.	No. of Lactation.	No. of Days in Milk.	No. of lb. of Milk.	
76	1	1st	360	9,202	2nd	293	9,799	— 597
122	?	1st	175	2,521	2nd	330	6,455	— 3,934
183	1	1st	292	5,580	2nd	275	6,198	— 618
188	2½	4th	242	6,863	5th	275	9,677	— 2,814
214	3	1st	365	9,255	2nd	272	10,452	— 1,197
217	?	1st	175	2,521	2nd	330	6,455	— 3,934
348	1½	1st	280	4,671	2nd	302	6,639	— 1,968
							TOTAL	— 15,062
							Average	— 2,151

normal lactation following the abortion, and they show that as a result of 33 abortions there was a total loss of 71,436 lb. of milk, or an average of 2,164 lb. of milk at each lactation following an abortion. If this were expressed in terms of cash it would represent a considerable sum of money lost per aborting cow.

If the precedent established by the Attested Herd Scheme for assistance in the control of tuberculosis were extended to the control of contagious abortion, and a plan similar to the one adopted in the control of the disease in the herd now reported on, were followed, the cost of eradication in favourably-situated herds might be very small. Even if a charge were made for carrying out the laboratory tests, provided this were a moderate one, the cost of eradication might still be modest. In this herd, just over 4,000 blood samples were tested.

SUMMARY

Over a period of nearly six years, contagious abortion has been effectively controlled in a herd of 180 or more cows. At the first test and during

Bovine Contagious Abortion*

PART I.—EXPERIMENTS WITH A NEW TYPE OF DEAD VACCINE

W. R. KERR
Veterinary Research Division,
Ministry of Agriculture for Northern Ireland

Some six years ago discussions were held with M. Henri Spahlinger on his methods of vaccine production, and more particularly on the preparation of his dead anti-tuberculosis vaccine. As an outcome of these discussions it was decided to attempt the production of a dead vaccine against contagious abortion following the principles put forward by M. Spahlinger. A preliminary note on the production of this vaccine has already been published (Kerr, Lamont and Shanks, 1935).

The principles underlying M. Spahlinger's methods of vaccine production may be summarised as follows:—

(1) It has been long recognised that the morphology and virulence of organisms may be altered by cultivation on artificial media or by repeated passage of the organism through animals. It is questionable whether the antigens in vaccines produced from such attenuated organisms are absolutely identical with those produced by the organism as it occurs naturally.

If the organisms could be cultured upon unaltered body fluids or tissues, then it should be possible to produce organisms more closely identical in structure and virulence with those originally isolated. Such organisms might be expected to produce toxins more closely identical with the toxins produced by the naturally occurring organism, and these toxins in their turn might be expected to evoke the production of antibodies of greater efficacy against the naturally occurring toxins than antibodies produced by the more customary standard methods.

It would follow, therefore, that in order to produce a vaccine of maximum efficacy, a virulent strain of the organism, unaffected by cultivation upon artificial media or by passage through animals, should be isolated and cultivated upon unaltered body fluids, so that the environment may approximate as closely as possible to the natural environment.

(2) As a further extension of this principle, the organism should be allowed to die a natural death after cultivation. This would obviate possible alterations of the antigens by treatment with heat or chemicals.

It is clearly difficult to apply these principles completely owing to the necessity for such operations as sterilisation and for a correct selection of the natural culture medium. In the experiments now reported the natural medium was mixed uterine fluid withdrawn aseptically from the uterus of a pregnant cow and sterilised by filtration through large Seitz filters. Drastic sterilisation treatment was avoided by this method.

Preparation of Media.—Trypsin agar was distributed in 10 oz. screw-capped bottles, and when the temperature of the agar had fallen to 60° C., the uterine fluid was added so as to represent 15 per cent. of the total volume. The bottles were then sloped.

When the agar had solidified, approximately 2 oz. of uterine fluid were added to each bottle. The bottles were then incubated for 48 hours to test sterility.

Cultivation Technique.—The medium was seeded directly with a virulent strain of *Brucella abortus* recently isolated from the abomasum of a foetus. Incubation was carried on for a period of from eight to twelve months at 37° C. A heavy growth was obtained aerobically on this medium even in primary cultures.

M. Spahlinger had recommended the addition of a trace of antiseptic for preservation purposes. In this instance owing to the inadequacy of tests to indicate viability euflavine 1 to 10,000 was at first employed; subsequently formalin 0·2 per cent. was used instead of euflavine, the addition being followed by a further incubation for one month.

Fuller details of the method of preparation may be found in the preliminary note (Kerr, Lamont and Shanks, 1935) the only subsequent changes in technique being the use of formalin and the extension of the incubation period to eight to twelve months.

Experiments with Guinea-pigs

Attempts to induce resistance to *Brucella abortus* in guinea-pigs by means of dead

*Presented at a joint meeting of the North and South of Ireland Veterinary Associations held at Belfast, June 4th, 1938.

the following 17 months 84 animals reacted to the test for contagious abortion. Since then only one reactor to the test has been detected. The reacting animals were kept while it was profitable to maintain them, and six of the original 84 reacting animals were still on the farm nearly six years after having shown a positive reaction. The losses sustained by the sale of animals because they were reactors to the test for contagious abortion and by the slaughter of one animal because she reacted to the test amounted to £40 9s. 6d. These losses were the only costs attributable to the control of the disease.

vaccine are few in number, and have usually given negative results. A comprehensive bibliography is given by McEwen and Roberts (1936).

Preliminary experiments with the new dead vaccine, using small numbers of guinea-pigs, suggested that it had exerted a definite antigenic effect. In the subsequent extended experiments with guinea-pigs larger numbers were used, and the results obtained with three groups of guinea-pigs are described below.

Technique.—Male guinea-pigs were used in the experiments now reported. Both female guinea-pigs and rabbit does had been used in previous breeding experiments, vaccination having been carried out prior to mating. Sterility was so common that these experiments were discontinued. The sterility affected vaccinated and control animals to an equal extent, so that vaccination did not appear to be responsible. *Brucella abortus* was recovered from the uterine discharges of the infected females and multiple abscessation of the uterine wall was also recorded. McEwen and Roberts (1936) noted similar results in rabbit does.

Vaccination.—The dose used was 0·5 c.c. injected subcutaneously. When more than one injection was given an interval of 14 days was observed between injections.

Infection

An emulsion of freshly isolated *Brucella abortus* equivalent to No. 1 tube on the Brown scale was prepared. One drop of this was instilled into the eye ten days after the date of the last vaccination. This dose may be considered severe, since it is known that a very dilute suspension of *Brucella abortus* instilled into the eye will set up infection with regularity.

The degree of resistance to infection was estimated from the extent of the macroscopical lesions present. In the early experiments the cultivation of the organism from the spleen was accepted as a criterion, but this method was discarded as being unreliable. Weight of spleen, presence of orchitis, abscessation of other organs and final condition of the guinea-pigs were adopted as criteria, except in Experiment I, where spleen weights were not recorded.

Experiment I.

This experiment comprised five groups of male guinea-pigs and the results are set out in Table I. The guinea-pigs were killed eight weeks after the infective dose.

Experiment 2.

This experiment was a repetition of Experiment I with certain modifications. Only one vaccinated group was included, and these animals each received three doses of vaccine. The spleens were weighed and cultured, and the guinea-pigs were killed 45 days after the infective dose had been given. The other details of technique were as in Experiment I. The results of Experiment II are set out in Table II.

It was unfortunate that two guinea-pigs died after the infecting dose had been given. They were unfit for examination and this circumstance to a certain extent nullified the statistical value of Experiment II. The orchitic abscesses in the control group were about half an inch in diameter.

Experiment III.

This experiment was a repetition of Experiment II and the results are set out in Table III.

Table I

Experiment 1

Group.	Number of Animals.	Doses of Vaccine.	Infection.	Spleen.	Orchitis.	Abscessation.	Condition.
4	8	Control	Virulent	All enlarged	2 abscessed	1 liver abscess	All emaciated
5	4	Control	Avirulent 13 years old	No macroscopic lesions			Good
1	4	1	—	All enlarged	1 abscessed	—	All emaciated
2	8	2	—	Grey nodulations	No macroscopic lesions		Good
3	8	2	—	Grey nodulations	No macroscopic lesions		Good

TABLE II

Experiment 2

No.	Group.	Vaccination Titre.	Weight Grammes.	Liver Grammes.	Spleen Grammes.	Spleen Culture.	Gross Lesions.
1	Vaccinated	100	640	37	1·75	+	S
2	,,	100	651	34	1·25	+	—
3	,,	100	587	36	1·50	+	—
4	,,	50	714	46	1·10	+	—
5	,,	100	657	41	1·00	+	—
6	,,	100	Died	—	—	—	—
7	,,	50	737	39	1·15	+	—
8	,,	200	659	43	1·15	+	—
9	,,	50	715	37	1·40	+	—
10	,,	50	728	43	0·80	+	—
11	,,	200	732	40	1·20	+	—
12	,,	200	669	40	1·50	+	—
13	Control	—	747	47	3·05	+	S.O.
14	,,	Died					
15	,,	,,					
16	,,	—	797	48	2·48	+	S.O.
17	,,	—	675	47	1·20	+	O.
18	,,	—	794	46	2·75	+	S.O.
19	,,	—	726	43	1·65	+	S.O.
20	,,	—	746	47	2·10	+	S.

O = Orchitic abscesses.
S = Marked enlargement of spleen.
Average weight of spleen in vaccinated group = 1·25 grammes.
,, ,, ,, ,, control ,, = 2·20 ,,

TABLE III

Experiment 3

No.	Group.	Weight Grammes.	Liver Grammes.	Spleen Grammes.	Spleen Culture.	Gross Lesions.
1	Vaccinated	704	51	1·47	+	—
2	,,	730	50	2·22	+	S.
3	,,	867	53	0·98	+	—
4	,,	880	50	3·00	+	S.
5	,,	737	48	1·37	+	—
6	,,	755	43	2·10	+	S.
7	,,	867	49	1·67	+	—
8	,,	822	47	2·30	+	S.
9	,,	648	52	2·73	+	S.
10	,,	640	Died			
11	,,	655	49	1·10	+	—
12	Control	733	37	4·03	+	S.O.
13	,,	754	40	1·47	+	—
14	,,	765	35	1·98	+	S.L.O.
15	,,	705	45	3·52	+	S.O.
16	,,	788	48	5·07	+	S.L.O.
17	Died before injection					
18	Control	783	41	1·50	+	O.
19	,,	620	46	2·11	+	S.O.
20	,,	780	38	4·60	+	S.O.
21	,,	650	48	2·00		S.O.
22	,,	647	40	4·34	+	S.O.

L = Liver abscess.
O = Orchitic abscesses.
S = Marked enlargement of spleen.
Average weight of spleen vaccinated group = 1·89 grammes.
,, ,, ,, control ,, = 3·16 ,,

The results of the *post-mortem* examinations of this group showed that the infective dose had been more virulent than in the previous experiment. Unfortunately the infective dose was a variable factor in our experiments, as in each experiment a new and virulent freshly isolated culture was used.

In view of the results of the foregoing experiments, and also for other reasons discussed below, it was decided to test the value of the new type of dead vaccine in conferring immunity on virgin heifers negative to the agglutination test for *Brucella abortus*.

The other reasons which influenced this decision were as follows:—

(*a*) The new type of dead vaccine had come largely to replace the standard avirulent live vaccines and dead vaccines previously issued by the Veterinary Research Division. Practitioners evinced a preference for the new vaccine, but the flying herd system prevalent in Northern Ireland did not allow any effective controls to be maintained and so mitigated against the possibility of obtaining satisfactory data in the field.

(*b*) Such an experiment would provide an opportunity of comparing the results of guinea-pig experiments with the results of a bovine experiment.

When designing the experiment some difficulty was experienced in deciding what was to be the measure of resistance. In the case of the experiments with guinea-pigs the presence of *Brucella abortus* in the tissues associated with relatively small pathological change as compared with the control animals was accepted as evidence of partial immunity.

Many instances of partial immunity are known to bacteriologists. When discussing partial immunity (Topley, 1933) remarks that a more complete immunity may be induced under optimal conditions. A definite economic value could be placed upon partial immunity induced by vaccination if it were such as to enable the cow to carry her calf to full term despite the presence of *Brucella abortus*, and of some degree of related pathological change. At the same time the affected animal would remain capable of disseminating the disease to healthy animals, a salient disadvantage of any partial immunisation.

Experiment with Bovines

Experiment IV.

This experiment was of simple design and was concerned with a comparison of the resistance of a vaccinated and of a control group of heifers to intensive infection. The experimental animals consisted of eleven vaccinated heifers and eleven control heifers. These animals were subjected to an intensive natural infection.

When selecting the experimental animals, any individual giving a positive agglutination test in a 1 in 12·5 dilution was rejected.

Cross-bred Aberdeen Angus heifers were utilised on the assumption that they might be freer of agglutinins that the more common dairy breeds. This assumption was to some extent justified as little difficulty was experienced in obtaining the necessary quota. None of the twenty-two heifers finally selected exhibited a positive agglutination test in a dilution of 1 to 12·5 on repeated subsequent tests.

The Relationship between Plasma Globulin and Agglutination Titre

Sometime prior to the present experiment observations were made on plasma albumin and globulin with a view to exploring their possible significance when considered in conjunction with agglutination titre. The results were of sufficient interest to warrant further investigation during the present experiment. Anything approaching a complete plasma protein fractionation was, unfortunately, impossible owing to limitations of time available for the work, but with the co-operation of the Chemical Research Division it was possible to estimate plasma albumin and globulin throughout the course of the experiment. This phase of the work is dealt with in Part II.

Technique.—Agglutination test: Blood serum was tested in dilutions of 1 to 10, 1 to 20, 1 to 40 up to a maximum of 1 to 10,240.

The antigen was made from a smooth thermo-stable strain of *Brucella abortus*. A 48 hour agar slope culture was washed and the emulsion diluted with sterile saline so as to match Brown's No. 1 tube.

The agglutination tubes were 6 mm. × 70 mm., 0·2 c.c. undiluted serum being placed in the first tube with 1·8 c.c. suspension and mixed by pipetting. 1·0 c.c. was then carried over to the next tube, diluted to volume, and so on up to the final dilution. Positive and negative controls were included with each group of agglutination tests.

Vaccination.—A 20 c.c. dose of the vaccine was employed. As stated in the preliminary note (Kerr, Lamont and Shanks, 1935) the suspension of vaccine was "five times as dense as No. 5 tube McFarland's nephelometer."

Vaccination was repeated at intervals of approximately 21 days. It was originally decided to give five injections, three before and two after service. The majority of the heifers failed to come in calf to the first bull used, and a second bull had to be introduced. This upset the time factor and further vaccinations were given. The primary consideration, however, was to attempt the production of a resistance to infection.

Infection

It was a fundamental object to secure an infection approximating as closely as possible to infection as it exists under natural conditions. It was also necessary to ensure that all the heifers received the infection at the same time in order to simplify the interpretation of the results. At the same time it was feared that a natural infection might lead to some of the controls aborting during the first pregnancy and some during the second. In order to overcome this, it was necessary to intensify the infection as far as possible, always bearing in mind that the infection must remain essentially natural.

On March 3rd, 1937, two cows, one of which had aborted within 48 hours and the other within 24 hours, were taken from herds experiencing an acute attack of contagious abortion. *Brucella abortus* was isolated from the aborted foetuses, and discharges from both cows gave a positive reaction when injected into guinea-pigs. There was thus no doubt as to the nature of the infection.

Two ounces of the discharge taken from the vagina of each cow were mixed with 500 c.c. sterile saline, and 10 c.c. of this mixture were sprayed into the mouth of each experimental animal. A week later two further freshly aborted cows were obtained from a third herd, and discharge from these cows was collected, diluted with saline as described and sprayed over the hay. Arrangements were made so that each animal ate approximately the same amount of this treated hay.

From the commencement of infection the four discharging cows were closed up for two hours each morning in the feeding paddock with the 22 experimental heifers in order to ensure efficient contact. In addition all the animals were grazed together on the same paddock. The aborted cows were retained in the herd for one month.

The intensity of the natural infection secured in this way is shown by the results with the control animals, of which 100 per cent. aborted.

The following additional points were investigated:—

(1) All calves born alive were subjected to agglutination tests for *Brucella abortus* until such time as the animal gave a negative reaction.

(2) The milk and uterine discharge from each heifer were tested for the presence of *Brucella abortus* by injection into guinea-pigs. This procedure provided information on the percentage of the animals excreting the organism. The milk was centrifuged in 50 c.c. quantities for 20 minutes and 0·5 c.c. each of the fat and of the deposit were injected into a guinea-pig. In the case of the discharge 1·0 c.c. was injected directly.

The experimental results are presented in the form of individual graphs. (*See* pp. 722-724.) The graphs are grouped firstly into two main groups, those for the control animals and those for the vaccinated animals. Each group is then collated according to the relationship between plasma proteins and agglutination titre (*see* Part II).

The graphs provide a complete history of each animal during the experiment. With the aid of the appended key little difficulty should be experienced in reading each graph.

Results

(1) Resistance Experiment:

Control Group.

Of the ten pregnant animals in this group all aborted at periods ranging from 215 days to 250 days after service, with an average of 231 days. The remaining heifer of this group (B.5) apparently settled to the bull and subsequently showed no trace of oestrum until seven months after service, when the normal oestral periods recommenced. It was assumed that there was a distinct possibility of an early foetal death having taken place. While all the animals were exposed to infection at the same time it will be appreciated that this exposure occurred in some immediately prior to service and in others shortly after, due to the variation of oestral periods, and subsequent fertilisation. This, naturally, applied to both groups. With three exceptions the foetuses were born dead or died soon after birth. The exceptions, the calves of A.13, A.16 and B.8, lived and ultimately developed into satisfactory calves. The contents of the abomasum in the seven cases were positive on cultural examination and guinea-pig inoculation.

Vaccinated Group.

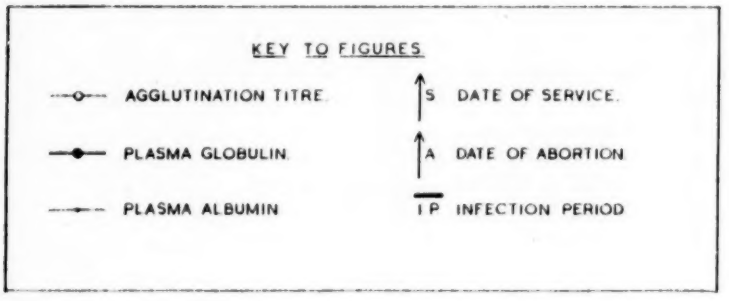
Two of the eleven animals carried their calves to the normal time. The calves were born alive and apparently healthy. Nine aborted in periods varying from 207 days to 268 days with an average of 232 days. Five calves lived and ultimately developed into normal animals, A.17, A.10, A.22, B.15, A.19. At a later date A.22's calf died. The cause of death was not discovered. The contents of the abomasum of aborted foetuses in this group were positive on cultural examination and guinea-pig inoculations.

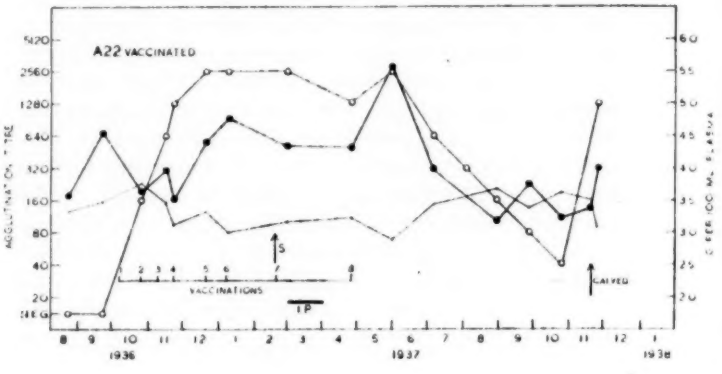
(2) Agglutination Titres:

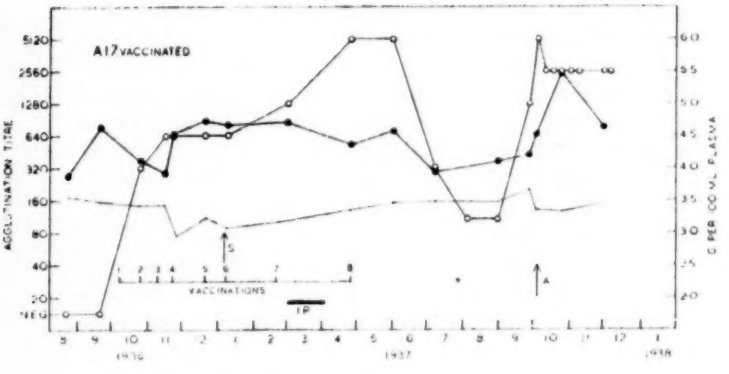
Control Group.

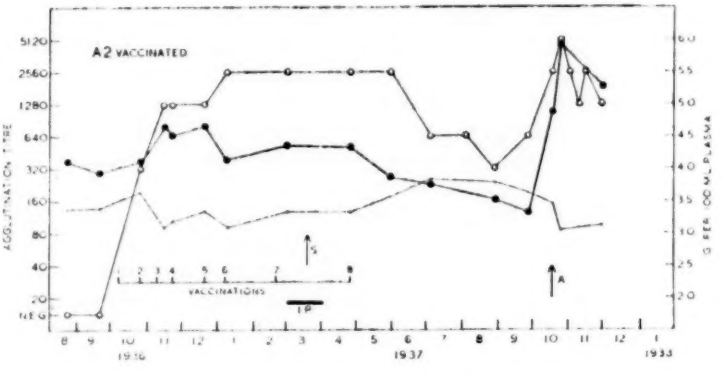
Attention may be directed to the agglutination titres manifested in this group, since these are of some interest when considered in relation to the various accepted standards for positive reaction.

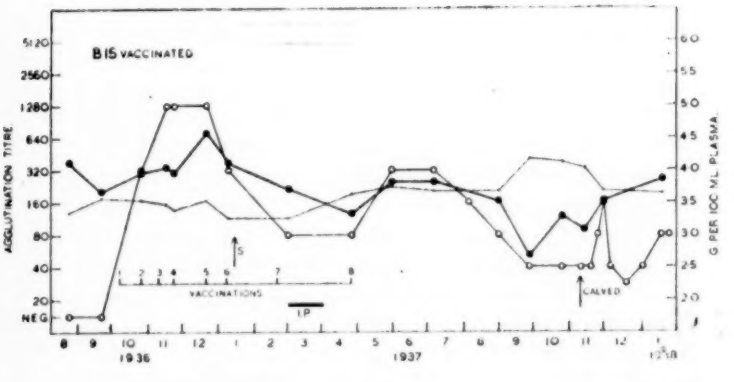
As described above, each animal received the diluted infection *per os* and was then exposed

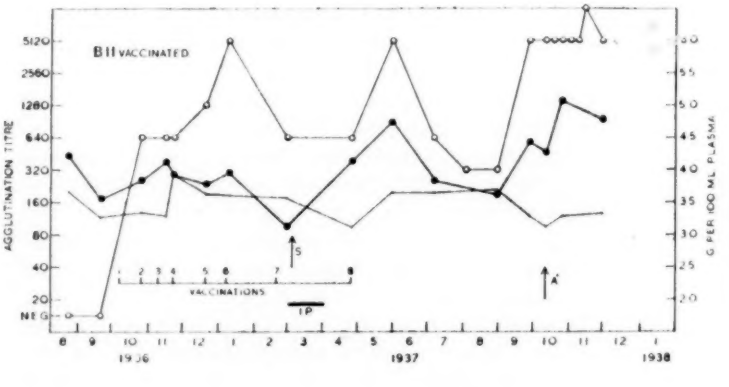

KEY TO FIGURES
AGGLUTINATION TITRE
PLASMA GLOBULIN
PLASMA ALBUMIN
S DATE OF SERVICE
A DATE OF ABORTION
I P INFECTION PERIOD

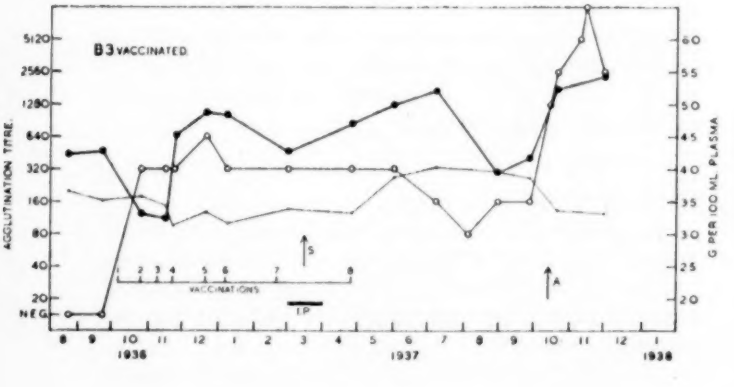

A22 VACCINATED
AGGLUTINATION TITRE
G PER 100 ML PLASMA
VACCINATIONS
CALVED
1936
1937
1938

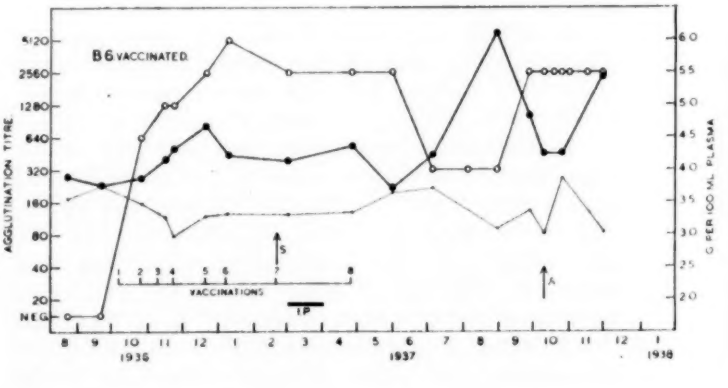

A17 VACCINATED
AGGLUTINATION TITRE
G PER 100 ML PLASMA
VACCINATIONS
1936
1937
1938

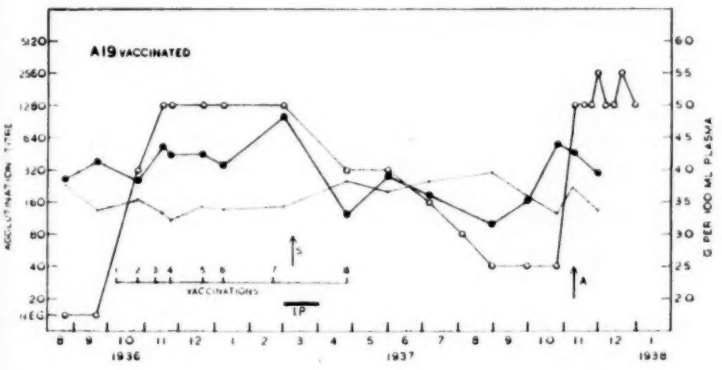

A2 VACCINATED
AGGLUTINATION TITRE
G PER 100 ML PLASMA
VACCINATIONS
1936
1937

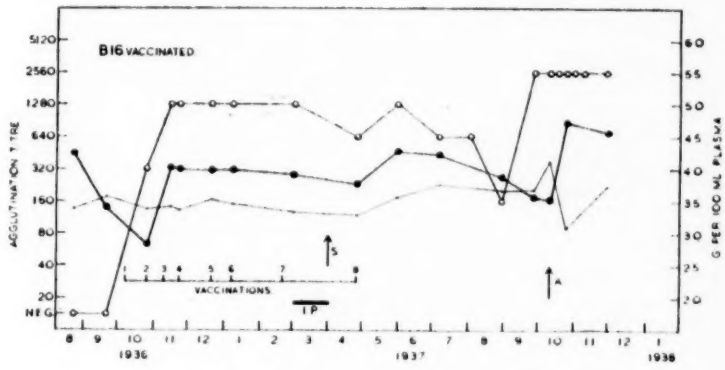

B15 VACCINATED
AGGLUTINATION TITRE
G PER 100 ML PLASMA
VACCINATIONS
CALVED
1936
1937

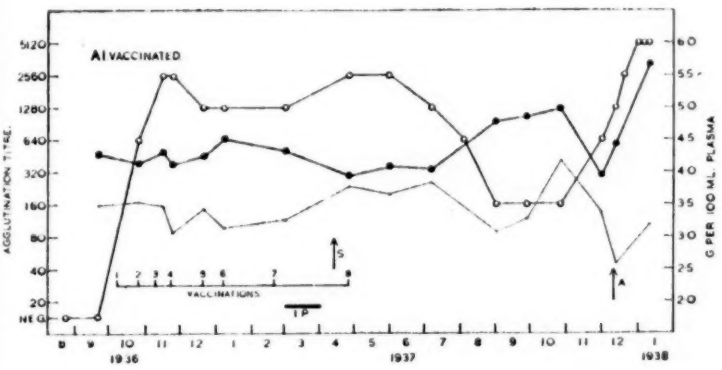

B11 VACCINATED
AGGLUTINATION TITRE
G PER 100 ML PLASMA
VACCINATIONS
1936
1937
1938

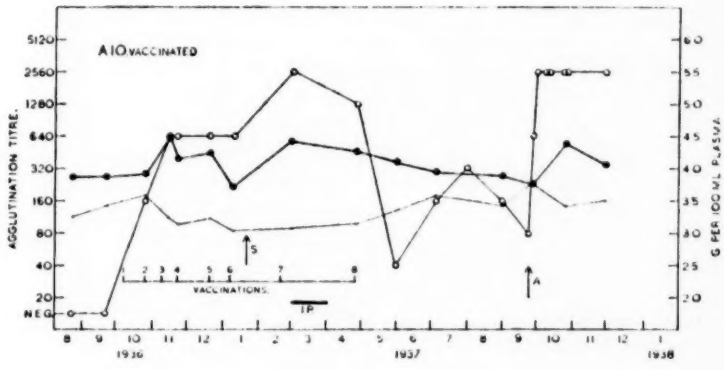

B3 VACCINATED
AGGLUTINATION TITRE
G PER 100 ML PLASMA
VACCINATIONS
1936
1937
1938

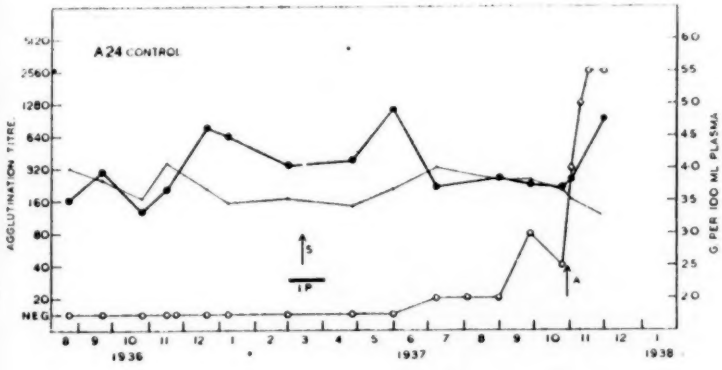

B6 VACCINATED
AGGLUTINATION TITRE
G PER 100 ML PLASMA
VACCINATIONS
1936
1937
1938

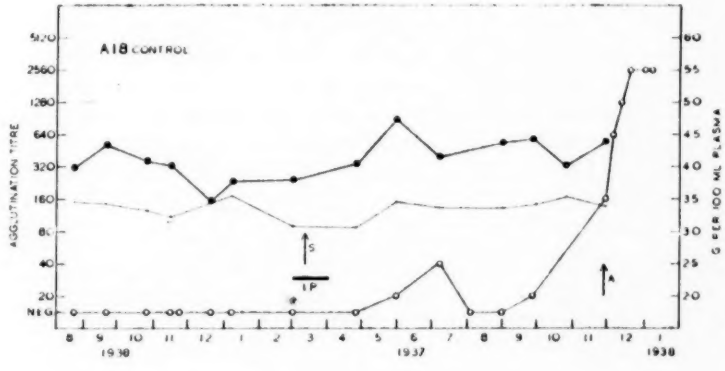

A19 VACCINATED
AGGLUTINATION TITRE
G PER 100 ML PLASMA
VACCINATIONS
S
TP
A
1936
1937
1938

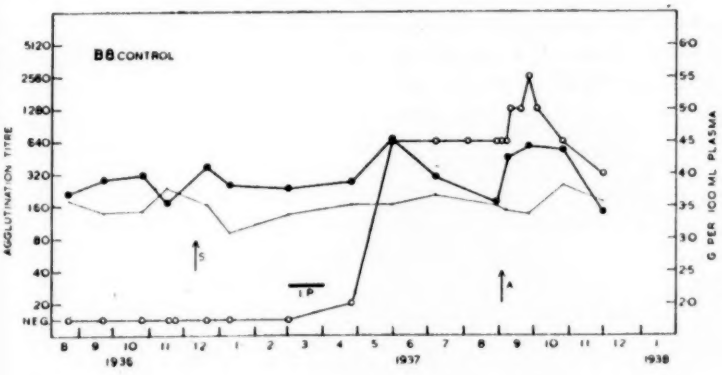

B16 VACCINATED
AGGLUTINATION TITRE
G PER 100 ML PLASMA
VACCINATIONS
S
TP
A
1936
1937
1938

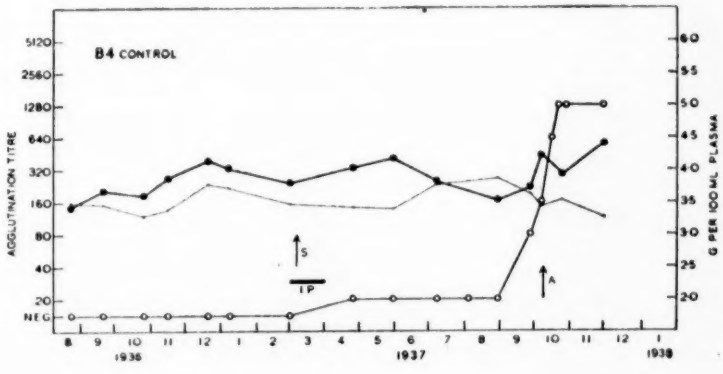

A1 VACCINATED
AGGLUTINATION TITRE
G PER 100 ML PLASMA
VACCINATIONS
S
TP
A
1936
1937
1938

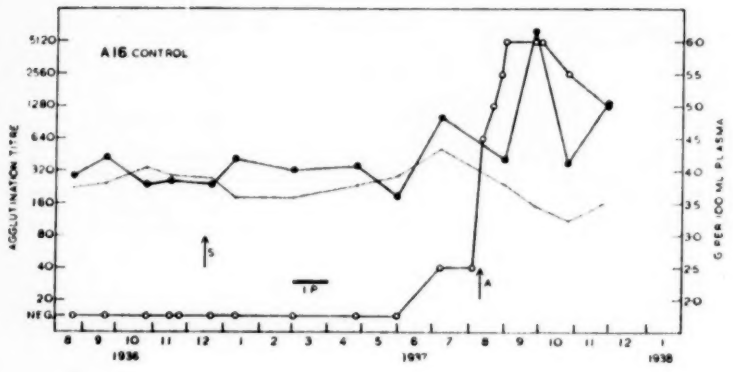

A10 VACCINATED
AGGLUTINATION TITRE
G PER 100 ML PLASMA
VACCINATIONS
S
TP
A
1936
1937
1938

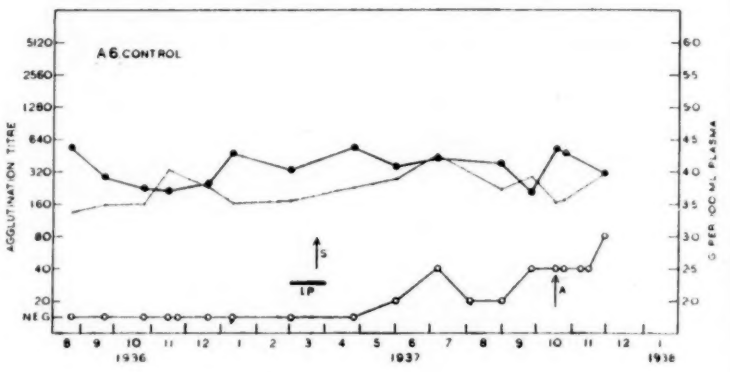

A24 CONTROL
AGGLUTINATION TITRE
G PER 100 ML PLASMA
S
TP
A
1936
1937
1938

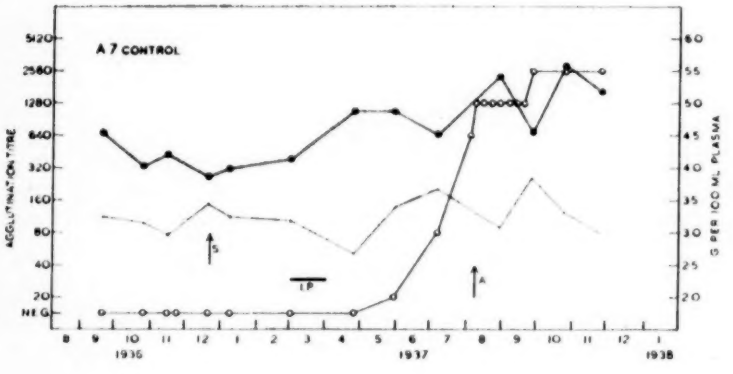

A18 CONTROL
AGGLUTINATION TITRE
G PER 100 ML PLASMA
S
TP
A
1938
1937
1938

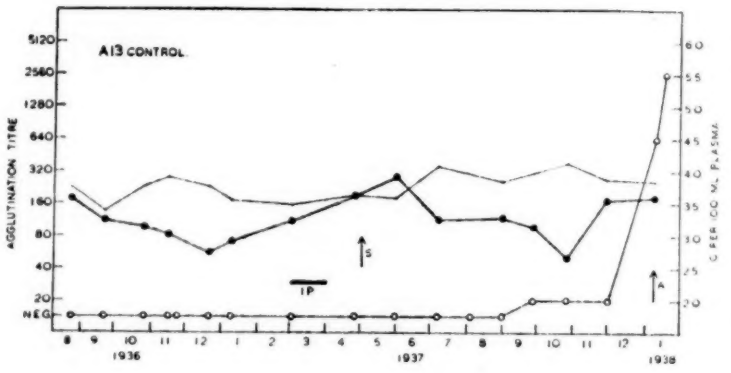

B8 CONTROL
AGGLUTINATION TITRE
G PER 100 ML PLASMA
S
TP
A
1936
1937
1938

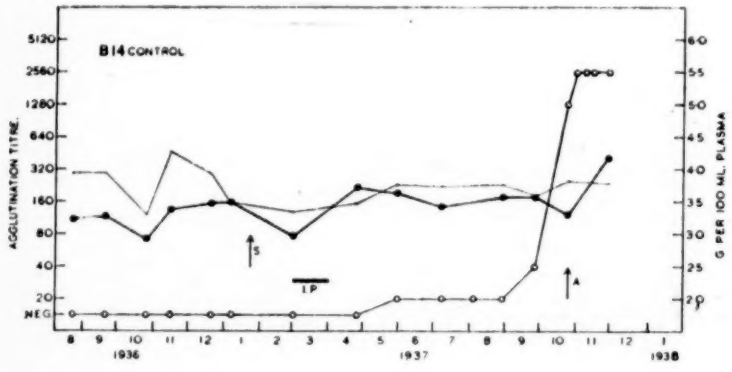

B4 CONTROL
AGGLUTINATION TITRE
G PER 100 ML PLASMA
S
TP
A
1936
1937
1938

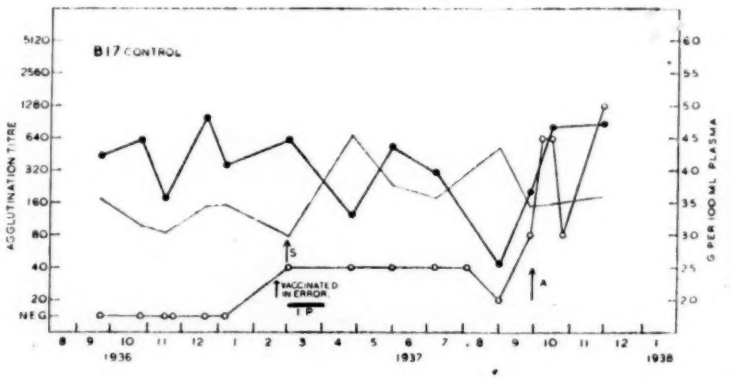

A16 CONTROL
AGGLUTINATION TITRE
G PER 100 ML PLASMA
NEG
S
I.P.
A
1936
1937
1938

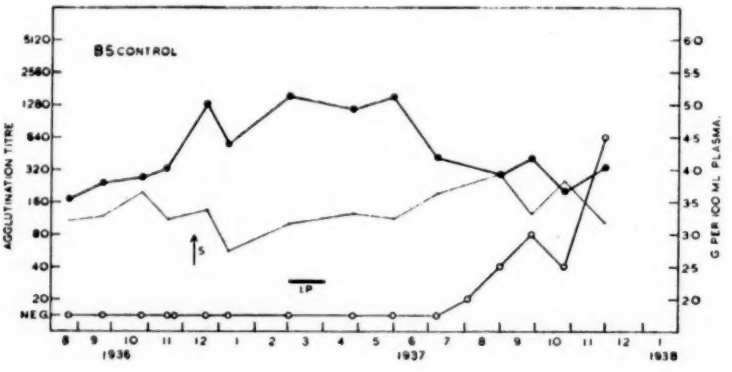

A6 CONTROL
AGGLUTINATION TITRE
G PER 100 ML PLASMA
NEG
S
I.P.
A
1936
1937
1938


A 7 CONTROL
AGGLUTINATION TITRE
G PER 100 ML PLASMA
NEG
S
I.P.
A
1936
1937
1938


A13 CONTROL
AGGLUTINATION TITRE
G PER 100 ML PLASMA
NEG
S
I.P.
A
1936
1937
1938


B14 CONTROL
AGGLUTINATION TITRE
G PER 100 ML PLASMA
NEG
S
I.P.
A
1936
1937
1938


B17 CONTROL
AGGLUTINATION TITRE
G PER 100 ML PLASMA
NEG
S
VACCINATED IN ERROR
I.P.
A
1936
1937
1938


B5 CONTROL
AGGLUTINATION TITRE
G PER 100 ML PLASMA
NEG
S
I.P.
1936
1937
1938

to intense natural infection for a period of one month. The following features of the agglutination titre values may now be pointed out.

(*a*) Ten out of the eleven animals failed to show any reaction for an average period of 16 weeks following the initial infection. The actual periods varied from one month 24 days in some of the animals to six months 25 days in others. Nevertheless the abortions in this group occurred after approximately the same period had elapsed since the initial infection.

(*b*) At approximately one month prior to the date of abortion five animals, B.17, A.13, A.6, A.18 and B.4, recorded agglutination titres in the low dilution of 1:20; three animals, A.24, B.14 and A.16, recorded titres of 1:40; one animal, A.7, recorded a titre of 1:80; and one animal recorded a titre of 1:640.

(*c*) One animal, A.6, maintained a steady titre of 1:40 for six weeks after abortion, ultimately rising to a peak value of 1:80.

(*d*) The majority of the animals recorded titres of 1:2,560 one month after abortion. The maximum titre recorded was 1:10,240.

At this point certain anomalous results may be discussed. B.17 received one dose of vaccine by error on 19th February, 1937; 14 days later she exhibited a titre of 1:400, but this quickly fell to 1:40, ultimately dropping to 1:20 four weeks before abortion took place.

B.5 proved not to be in calf. Five months after infection this animal showed a titre of 1:20, and three months later the titre had risen to 1:640.

The graph for A.18 has peculiar features. Three months after infection the titre was 1:20, one month later it was 1:40, but during the next two months agglutination only occurred in a dilution of 1:10. One month prior to abortion the titre was 1:20; a quick rise then took place to a value of 1:2,560.

The low and delayed agglutination titre following upon intense natural infection of animals which subsequently aborted is a disturbing feature of this experiment, more especially in view of the application of agglutination tests to segregation methods for the control of contagious abortion. Several questions readily suggest themselves. What is to be regarded as a positive agglutination titre, a dilution of 1:10, or of 1:20 or of 1:80? Does a low titre indicate a potential aborting animal in a recent outbreak of contagious abortion? Does a very high titre indicate an aborted animal more often than a potential aborting animal?

In the present experiment eight of the eleven control animals exhibited a much delayed response to the agglutination test, and this is all the more striking since examination of the graphs shows than ten of the vaccinated animals exhibited a decided and immediate rise in agglutination titre on exposure to the same infection. It is true that in the vaccinated animals an agglutination response induced by the vaccine prior to infection was already present; nevertheless the response to infection was prompt and definite. Furthermore, the titres of these same eight control animals remained abnormally low until a period shortly before abortion, when the titres rose to very high levels. The delay and low values of the agglutination titres of these eight animals are difficult to interpret, but it may be assumed that, for a considerable period before abortion, the *Brucella abortus* organism had been localised in the pregnant uterus; this was borne out by the presence of the usual pathological changes and by subsequent abortion, and yet a decided agglutination reaction was not evident until the time of abortion.

The appearance of serum agglutinins when a definite period has elapsed since eye instillation or subcutaneous or intravenous injection of an emulsion of *Brucella abortus* has been carried out is a well-known phenomenon. It is also recognised that *per os* infection is less efficacious in the induction of agglutinin response, and although the organism is present in the digestive tract, it may be that injury to the membrane is necessary to permit its entry. The organism may well remain in the digestive tract for an extended period before gaining entrance to the tissues and later inducing the appearance of serum agglutinins. Moreover, the concentration of the organism may constitute a further factor. The results of this aspect of the experiment are of interest in the light of recent publications by Stableforth (1936).

Vaccinated Group.

The first injection of the vaccine excited an immediate response of agglutinins up to an average titre of 1:400. With the fourth injection an average titre of 1:2,560 was reached; this was followed by a decline in titre despite further injections of vaccine. The titre rose again when the animals were subjected to the intense natural infection, but fell off subsequently until just prior to abortion, when the titre rose to an average level of 1:2,560 and remained at this level until the end of the experiment.

Calf Agglutination Tests.

The calves were bled as soon as possible after birth, and further samples were withdrawn at intervals of seven days. In most cases the blood samples were withdrawn within 24 hours after birth or abortion. Several of the foetuses were bled just after abortion and when at the point of death.

Nine calves were tested, six from the vaccinated group and three from the control group.

Eight of the calves gave completely negative tests at birth. Within seven days the titre value had risen to 1:320 to 1:640. This increase was followed by a fall to negative values, *i.e.*, no agglutination in a 1:10 dilution. The period of positive reaction varied from three weeks to ten weeks, averaging six weeks.

It is assumed that in these cases the calf had obtained its agglutinins by absorption from the dam's colostrum, *i.e.*, a passive agglutinuation (Orcutt and Howe, 1922). Each calf suckled its dam during this period of the experiment.

The ninth calf, that from heifer, B.8, was born with a titre of 1:5,120, and this was maintained for three weeks, falling eventually to 1:2,560. At this time the titre of the dam's blood did not exceed 1:640. A gradual fall to negative reaction supervened, the total reaction period being twelve weeks. These facts strongly suggest a case of active agglutinin response, especially as the calf's titre was so much higher than that of the dam. Active agglutinin response is relatively uncommon.

Milk.—The presence of *Brucella abortus* in the milk was determined by injection of milk fat and deposit into guinea-pigs, the requisite milk samples being drawn four days after abortion. The guinea-pigs used showed no evidence of agglutination in two successive tests prior to the milk injections.

Of the vaccinated heifers, ten gave positive tests, and one gave a negative test.

Of the control animals, nine gave positive tests and one gave a negative test.

There was, therefore, no difference as between the two groups in this respect. Ninety per cent. of the milks obtained from cows exposed to natural infection contained *Brucella abortus*.

Uterine Discharges.—The uterine discharges of all 21 animals which calved or aborted were found to contain *Brucella abortus*.

Summary

(1) Experiments are described which were directed towards the induction of resistance to infection with *Brucella abortus* (Bang) by means of a new type of dead vaccine.

(2) In three of the experiments the experimental animals were guinea-pigs, and the results strongly suggest that the new type of dead vaccine had induced a partial immunity to infection with *Brucella abortus*.

(3) In a fourth experiment the resistance of vaccinated heifers to an intense natural infection was compared with that of unvaccinated control heifers.

All of the ten pregnant animals in the control group aborted, and only three of the aborted calves survived.

Nine out of the eleven pregnant heifers in the vaccinated group aborted, and five of the calves lived and were reared; the remaining two animals carried their calves to full term, and produced healthy offspring.

While it cannot be said that these results are of immediate practical economic value, it is suggested that the vaccinated group had acquired a certain degree of partial immunity as compared with the control group.

It is possible that this partial immunity was masked to some extent by the intensity of the infection.

(4) The results of the bovine experiment were comparable with those obtained in experiments with guinea-pigs.

(5) Ninety per cent. of the milk samples obtained from the 21 lactating heifers were positive to tests for *Brucella abortus*.

(6) Eight of the nine living calves displayed passive agglutinin response to tests for *Brucella abortus*, reverting to a negative agglutinin response at about six weeks after birth. The ninth calf displayed an active agglutinin response.

(7) The results of the agglutination tests on the control group were characterised by a low and delayed agglutination test. These observations suggest that agglutination standards as applied in segregation control of contagious abortion may need serious reconsideration.

Acknowledgements

The author wishes to express his thanks to Messrs. J. S. S. Inglis and E. McNab for their assistance during the course of the experiments.

References

Kerr, W. R., Lamont, H. G., and Shanks, P. L. (1935.) Methods used in the preparation of a new type of dead anti-abortion vaccine. Bovine uterine fluid as an enrichment medium. *Vet. J.* **91.** 307.

McEwen, A. D., and Roberts, R. S. (1936.) Contagious bovine abortion. The use of guinea-pigs in immunisation studies. *J. Comp. Path.* **49.** 108.

Orcutt, M. L., and Howe, P. E. (1922.) The relation between the accumulation of globulins and the appearance of agglutinins in the blood of new-born calves. *J. Exper. Med.* **36.** 291.

Stableforth, A. W. (1937.) The agglutination test for the diagnosis of epizootic abortion. *J. Comp. Path. & Therap.* (1936.) **49.** 251. *Bull. Off. Int. Epiz.* (1936.) **12.** 107.

Topley, W. W. C. (1933.) An outline of immunity.

BOVINE CONTAGIOUS ABORTION

PART II.—
THE RELATIONSHIP BETWEEN PLASMA PROTEINS AND AGGLUTINATION TITRE

R. H. COMMON and W. R. KERR,

Chemical Research Division and Veterinary Research Division, Ministry of Agriculture, Northern Ireland

Introduction.

The precise relationship between antibodies and the serum proteins is still obscure, although it may be stated with some confidence that antibodies are associated with the globulin fractions of the serum proteins. It is also well known that a considerable increase of serum globulin may accompany immunisation. However, it by no means follows that this increase of serum globulin is to be identified with antibodies in the form of protein, for the increase does not bear any definite quantitative relation to the increase in antitoxic potency, and an antibody which may appear in a particular serum globulin fraction when prepared from the serum of one animal may appear in other fractions of the serum globulin when the antibody is produced in another animal. An increase of serum globulin may also follow the injection of serum, Witte's peptone, gelatine and other substances (Reymann, 1924). The monograph of Marrack (1938) may be consulted for more detailed information. The increase in serum globulin is often accompanied by a compensatory decrease in serum albumin, so that the increase in total serum protein is often smaller than the increase in serum globulin. Indeed Reitstötter (1920) has reported instances where horses undergoing immunisation against diphtheria had been brought to the point where the albumin fraction of the serum proteins had apparently completely disappeared.

Attempts to relate antibodies to particular fractions of the serum globulin have met with many difficulties, some of which have already been mentioned, but in general it appears that the pseudoglobulin and euglobulin fractions are those most closely associated with antibodies. Orcutt and Howe (1922) have shown that the *Brucella abortus* agglutinins which the newly-born calf acquires by the ingestion of colostrum are associated mainly with the direct absorption of the euglobulin and pseudoglobulins of colostrum. Lack of uniformity in the methods adopted for the separation of the various globulin fractions and uncertainty as to whether or no the various fractions are artefacts are among the circumstances which have added to the difficulties of interpreting much of this work. The position is summarised by Marrack (1938) who says that "it appears that the properties of antibodies indicate that they consist of modified serum globulin."

In spite of the difficulty of interpreting such observations, it was felt that determinations of plasma albumin and globulin during the course of Experiment 4 might provide information of interest.

Analytical Methods. — Blood samples were drawn from the neck veins of the heifers, heparin being used as anticoagulant. Plasma albumin and plasma globulin were determined by the macro-modification[2] of Howe's method as described by Peters and Van Slyke (1932).

Preliminary Results

A preliminary survey of normal heifers, of heifers in the course of vaccination against *Brucella abortus* and of heifers which had aborted, suggested that a rise in plasma globulin had accompanied vaccination and the consequent increase of agglutination titre, and that an even larger increase might take place at the time of abortion or immediately afterwards. The average values for these animals are given in Table I.

These animals were chosen at random in the field and it is questionable how far they were comparable. However, it may be remarked that the difference in plasma globulin between Groups A and C was highly significant statistically, while none of the other differences were significant. In addition, there was a fairly close negative correlation between plasma albumin and plasma globulin for Groups B and C but not for Group A. It was

Table I

Group Description.	Plasma Albumin g/100 ml. Plasma.		Plasma Globulin g/100 ml. Plasma.		Ratio $\frac{\text{Albumin (A)}}{\text{Globulin (G)}}$
	Mean.	Standard Error of Mean.	Mean.	Standard Error of Mean.	
A. Negative reactors (8) ...	3·83	± 0·2385	3·86	± 0·0985	0·99
B. Vaccinated heifers (7) ...	3·52	± 0·1179	4·38	± 0·3141	0·80
C. Abortion infection (19)	3·43	± 0·0729	4·52	± 0·1251	0·76

considered that these observations warranted further investigation along the same lines during the course of the experiment described in Part I.

The data secured are set out in full in the graphs which accompany Part I. The average values obtained during the preliminary period before vaccination and service, are set out in Table II.

Table II

Animals.	Total Plasma Protein g/100 ml.	Plasma Albumin g/100 ml.	Plasma Globulin g/100 ml.	Ratio $\frac{\text{Albumin (A)}}{\text{Globulin (G)}}$
Negative reactors (41 determinations) ...	7·44	3·53	3·91	0·89

It will be noted that the values given in Table II are reasonably close to the values previously obtained for negative reactors (see Table I). Published data with regard to the blood proteins of the cow for comparison with these values appear to be rather scanty. Wladasch (1936) has reported the following values based on the blood analyses of ten cows:—

	Total Protein g/100 ml.	Serum Albumin g/100 ml.	Serum Globulin g/100 ml.	$\frac{\text{Albumin}}{\text{Globulin}}$
Highest value ...	7·09	3·79	3·44	1·41
Lowest value ...	6·31	3·19	2·65	1·06
Average value ...	6·67	3·60	3·07	1·17

These analyses are distinctly lower than those found during the present observations so far as globulin is concerned, but this is doubtless partly due to the fact that Wladasch made his determination on serum, so that his globulin figures do not include fibrinogen. The fibrinogen content of normal human blood is about 0·2 to 0·4 grammes per 100 ml. (Peters and Van Slyke (1931); that of normal heifers does not yet appear to have been established, but a few analyses by the writer gave values ranging from 0·76 to 0·88 grammes per 100 ml. plasma. Folley and Peskett (1934) report an average value of 7·97 g/100 ml. for the total protein of bovine plasma as determined gravimetrically; a value of 7·73 grammes per 100 ml. may be calculated from their data for total plasma nitrogen and non-protein nitrogen, using the factor 6·25 for converting nitrogen to protein. This value of 7·73 grammes per 100 ml. plasma agrees tolerably well with the values for total plasma protein secured with negative reactors in the course of the present work.

Results Obtained with the Control Group

Turning to the present experiment, and considering first of all the results obtained with the control group, it is possible to separate this group into two sub-groups:—

(1) A larger group displaying very similar trends in the blood picture, and

(2) a smaller group, comprising Nos. B. 17 and B. 5, whose blood pictures depart considerably from the trends apparent in the larger group.

In the case of the larger sub-group (1), it will be noticed that Nos. A.24, A.18, B.8, B.4, A.16 and A.6 display a closely similar blood picture. The albumin-globulin ratio (A/G) ranges from about unity to about 0·8. In the case of A.7 the A/G ratio is consistently low, ranging from 0·6 to 0·9, while in the cases of A.13 and B.14 the A/G ratios tend consistently to be greater than unity, rising as high as 1·3 and 1·4. It is possible that this points to the A/G ratio as being in some measure an individual characteristic. All the animals of this sub-group (2) with the exception of A.6 displayed a sharp increase in agglutination titre in association with abortion, and in every case, with the exception of A.18, there was also a sharp rise in the plasma globulin. (It is not improbable that a similar sharp rise would have been found in the case of A.18 had further analyses been made.) Plasma albumin was relatively unaffected, or varied in the inverse sense to plasma globulin, so that loss of fluid in association with abortion and consequent concentration of blood proteins do not account for the increase in plasma globulin.

Among the animals of the control group, A.18 suffered from an attack of actinomycosis in June, while A.16 underwent an attack of pyogenic mastitis in July. These intercurrent infections do not appear to have upset the general blood picture in relation to *Brucella abortus* infection, and it is scarcely possible to discriminate any results of these infections in the graphs.

The anomalous blood pictures of B.17 and B.5 are both to some extent explicable. B.17 received one dose of vaccine in error, and thus

acquired a small agglutination titre; it is not surprising that the blood analyses depart from those obtained with the other control animals. B.17, however, displays the sharp rise in plasma globulin and agglutination titre in association with abortion. The case of B.5 is peculiar; this animal acquired a very high plasma globulin, with a correspondingly depressed plasma albumin, after service, although before that point the blood picture had been normal. This anomalous blood picture faded out gradually from seven to eight months after service. The interesting feature of this case is that B.5 did not calve nor was any indication of abortion detected. It was concluded that B.5 had undergone a false pregnancy, a circumstance which may be connected with the peculiar behaviour of the blood proteins.

Results Obtained with the Vaccinated Group

The results with the vaccinated group may be summed up broadly in the statement that there was a general parallelism between agglutination titre and plasma globulin, this being more or less marked in different animals.

In the cases of A.22, A.17, A.2, B.15, B.11 and B.3 this general parallelism is quite distinct. In the cases of B.6 and A.19 the correspondence is not so close in so far as the final increase in plasma globulin precedes the final increase in agglutination titre, while in the case of B.16 the final increase in plasma globulin is delayed with respect to the final increase in titre. The same tendencies may be seen in the graphs for A.1 and A.10, but in much lesser degree than in the majority of the vaccinated animals; however, the sharp final rise of serum globulin was quite distinct in the case of A.1.

In general the final increase in titre corresponds closely with the date of abortion, or with the date of calving in the cases of A.22 and B.15. The final increases in plasma globulin are, on the average, of greater magnitude than in the control animals, and in several cases very high plasma globulin figures were recorded, notably in the cases of A.2, B.6, A.1 and B.3. Plasma albumin was either relatively unaltered or was altered in the opposite sense to plasma globulin, thus obviating the possibility of the changes being a reflection of alterations in blood composition due to losses of fluid.

During March A.22 was very ill and ran a slight temperature. The trouble was not diagnosed with certainty but was most probably digestive, and it did not appear to affect the plasma proteins. During July A.1 suffered from an attack of pyogenic mastitis, which may, or may not, be associated with the high plasma globulin during August, September and October, at a time when the agglutination titre had fallen considerably.

The earlier increase in plasma globulin associated with the vaccination period is, in general, accompanied by a decrease in plasma albumin, and the changes tend to fade out a month or so after vaccination is completed. This increase of plasma globulin during vaccination is a confirmation of much previous work, as has been explained above. It is not even necessarily due to the *Brucella abortus* toxins and antigens; other protein substances in the vaccine might well have been responsible in part or in whole.

The rise associated with abortion or with calving must be regarded from another angle. Two interpretations are at present possible among others.

(1) It is a normal accompaniment of calving, and also accompanies abortion. Unfortunately it has not yet been possible to accumulate data with a view to settling this point.

(2) It is associated with the presence of antigens engendered in some way by the abortus organism just prior to the time of abortion. This, of course, is the more tempting conclusion.

There may be other possible interpretations but without doubt the final rise in serum globulin, which is especially pronounced in the vaccinated animals, constitutes the most interesting observation made on the plasma protein changes during the experiment.

The authors wish to thank Mr. R. W. Hale for his assistance with the statistics embodied in this paper.

Summary

(1) In heifers vaccinated with a dead vaccine against *Brucella abortus* the plasma globulin tended to rise in association with the agglutination titre.

(2) Vaccinated heifers and unvaccinated control heifers which had acquired a heavy infection with *Brucella abortus* displayed a sharp increase of plasma globulin in association with abortion as well as a sharp rise in agglutination titre.

References to Literature

Folley, S. J., and Peskett, G. L. (1934.) Experiments on Variations in Blood Composition. *J. Physiol.* **82.** 486.

Marrack, J. R. (1938.) The Chemistry of Antigens and Antibodies. Med. Res. Council Special Report Series. No. 230.

Orcutt, M. L., and Howe, P. E. (1922.) The Relation Between the Accumulation of Globulins and the appearance of Agglutinins in the Blood of New-born Calves. *J. Exper. Med.* **36.** 291.

Peters, J. P., and Van Slyke, D. D. (1931.) Quantitative Clinical Chemistry, Vol. I.

——— ———. (1932.) Quantitative Clinical Chemistry, Vol. II.

(*Concluded at foot of col.* 1, *page* 730.)

Trichomonas Disease of Cattle

OBSERVATIONS IN NORTHERN IRELAND

W. R. KERR, M.R.C.V.S., D.V.S.M., and
H. G. LAMONT, M.Sc., M.R.C.V.S.
Veterinary Research Division, Stormont.

The paper by Stableforth, Scorgie and Gould (1937)[1] has prompted the writers to make investigations to determine if a similar type of infection exists in Northern Ireland.

Sterility disease is very common in Northern Ireland. It seems to come in waves and in some areas is so serious that large numbers of cows fail to produce calves for long periods. Cattle-breeders expect their cows to produce one calf every twelve months but as the result of sterility farmers consider themselves fortunate if their cows produce two calves in three or even four years.

Northern Ireland is a country of small holders and so, as part of its cattle breeding scheme, the Government subsidises bulls, known as premium bulls (really communal bulls) in every district. The number of farmers who maintain bulls solely for the use of their own herds is negligible. Such a state of affairs, of course, is eminently favourable to the spread of diseases of the reproductive system. In the course of our enquiries we have interviewed farmers and examined cows which they told us had been sent to as many as five different premium bulls without success. In some districts where inquiries have been made we find that as high a figure as 80 per cent. of the cows have been returning to the bull. Mr. Hart, M.R.C.V.S., Enniskillen, in two years treated 832 cows for sterility. In one district, the first in which we made inquiries, we found a small community of six farmers sharing a bull and out of some 80 cows, only five were believed to be in calf. Trichomonads were easily detected in the uterine and vaginal discharges. Our survey has shown that this infection is widespread in Northern Ireland.

In one district where considerable trouble has been experienced from sterility associated with the presence of Trichomonas, the farmers blamed a Friesian bull for introducing and spreading the disease. This bull was slaughtered and through the courtesy of Mr. A. McLean, Belfast City Veterinarian, we were able to secure the penis and sheath immediately after slaughter. Examination showed that trichomonads were very numerous. Five complete days had elapsed from his last service until the examination was made. No lesions were observed on the penis although the history indicated that this bull had been spreading infection for six or seven months.

Clinical Data.

The excellent description given in the paper by Stableforth, Scorgie and Gould (1937) agrees closely with that noted in Northern Ireland. We should like to emphasise the following points.

(1) The cow or heifer is believed by the owner to be in calf, having passed safely the first heat period. The animal, however, returns to the bull at six, nine or twelve weeks. This is the usual history and the return of a number of animals after the lapse of three or four months is almost diagnostic of Trichomonas infection. Individual animals in a herd may return every three weeks and some animals do not manifest oestrum at all but fail to produce a calf at the end of term.

(2) The presence of a whitish discharge which is noted particularly when the animal should be coming into oestrum. This discharge or "white dirt," which is a descriptive term applied by local farmers, is held by the farmer to be evidence of the fact that the cow is "wasting" her calf. We have heard this striking phrase in almost every district—"wasting her calf." That the description is an apt one we have no doubt as we have examined several uteri *post mortem* filled with a creamy coloured fluid discharge with floccules in it, and have found a small mouse-like embryo surrounded by membranes floating in the discharge. The appearance of the discharge varies. This variation appears to correspond with the length of time infection has been in existence. A healthy cow which becomes infected at service usually commences to discharge at the end of the second three-week period. The discharge at this stage is somewhat like skimmed milk. A cow which has been infected and which has "wasted her calf" and has come in heat will recommence discharging in about two to four days after service. The appearance of the discharge in this case alters and becomes "glairy." It may take the form of a mucous discharge showing yellowish white flakes or streaks.

Reitstötter, J. (1920.) Sensibilisierung von Ferrihydroxysolen durch elektrolytfreie Eiweissfraktionen aus normalen und Immunserum. *Zschr. Immun. Forsch.* **30.** 507.

Reymann, G. C. (1924.) Untersuchungen über die Eiweissfraktionen im Serum diphtherieimmunisierter Pferde, nebst anderen die Immunisierung betreffenden Verhältnissen. *Zschr. Immun. Forsch.* **39.** 15.

Wladasch, A. (1936.) Das Verhältnis von Albumin zu Globulin im Blutserum gesunder Haustiere. *Biochem. Zschr.* 287, 337.

In the earlier stages of infection the trichomonas is easily demonstrated, but in the later stages great difficulty may be experienced in finding them. In some cases they may be found in numbers at a particular examination and perhaps three days later not a single trichmonas can be detected. The discharge is not offensive, but sooner or later it develops a typical catarrhal appearance.

In several outbreaks we have had striking circumstantial evidence that the bull carried the infection.

Abortions are not often noticed, but they do occur and owners have described to us the finding of small mouse-like embryos. The embryo is usually aborted in the membranes—these have the appearance of a very narrow sleeve about 24in. long, and the foetus can be felt as perhaps no bigger than a walnut, although often the animal has been thought to be in calf for several months. The membranes have a white macerated appearance. Arrested development of the foetus appears to be an important feature.

We have not observed any change in the appearance of the mucous membrane of the vagina which could be regarded as of any diagnostic value.

Stableforth, Scorgie and Gould refer to the tenseness and enlargement of the uterus on rectal examination. This tenseness and enlargment in our opinion is associated with the presence of discharge in the organ and the response of the tissues to this discharge. The fact has also to be considered that in many cases pregnancy has been in existence for some weeks before the death of the foetus takes place. In many instances the uterus may feel more flaccid than the normal. Repeated services seem to keep the disease in existence. As several owners put it, the service "feeds the disease and keeps the discharge going." Many animals have been known to recover after they have been allowed to miss several services.

It is important to note that spontaneous recoveries take place.

In our experience the greatest number of cases are to be found from September to January.

Laboratory Data

The following medium has been devised for the cultivation of the parasite.

Ringer's Solution	...	...	5 parts
Uterine Fluid .	...	...	2 parts
Serum	...	...	1 part

This is distributed in 40 c.c. quantities in Pyrex tubes and a piece of uterine mucous membrane added to each tube. The uterine mucous membrane is obtained from healthy non-pregnant uteri. The uterine fluid is collected from the pregnant uteri of animals slaughtered in Belfast abattoir, through the courtesy of Mr. A. McLean. The tubes are incubated and all contaminated tubes discarded.

The organism has been found to multiply in this medium. Cultures have been sent to Dr. M. Robertson at the Lister Institute. The description of the parasite—a microscopic flat fish, is an excellent one.

*Blood cultures from six affected cows have proved negative and 14 cultures from non-infected animals (*Vibrio foetus* had been recovered from an aborted foetus in this herd) were also negative. As a point of interest it may be stated that Dr. M. Robertson cultivated a trypanosome from one of these cows.

Treatment

Hitherto we have relied on Nielsen's sterility treatment: an aqueous solution of iodine, 1—200 to 1—400, has been used. The uterus is pumped full of this solution and it is left in the organ. The *os* is irrigated very carefully and the vaginal cavity is thoroughly douched. In about 70 per cent. of cases success has followed this treatment.

Our thanks are due to Dr. Stableforth and his colleagues for their excellent article.

Reference

[1]Stableforth, Scorgie and Gould. (1937.) *Vet. Rec.* 49. 8 and 9.

*The medium used was coagulated serum plus Ringer's solution and starch.

DYSENTERY FROM MILK: SONNE TYPE INFECTION

In the *British Medical Journal*, of May 21st, Dr. G. K. Bowes, Medical Officer of Health, Bedford, gives an account of an outbreak of dysentery, which was caused by dysentery bacilli of the Sonne type and traced to the consumption of milk delivered in the town daily by a retailer who obtained all his supplies from a farm about seven miles away. Fifty-nine out of 106 households, or 96 among 224 (estimated) individuals were affected. The incubation period was usually 12 to 24 hours, and symptoms, which in most cases were mild, consisting of abdominal pain, vomiting and diarrhoea, lasted 12 to 36 hours. The actual source of infection of the milk remained untraced, but the distribution of cases seemed to make it reasonably clear that the milk had been infected in the town and not on the farm or in the course of conveyance to the town. The Ministry of Health append that Sonne infection of milk has not previously been reported. Further, very full and laborious enquiries have been made into the origins of outbreaks of dysentery during the recent prevalence, but so far nothing tangible has resulted, except that in two instances an article of food was found to be infected with the Sonne bacilli.

The Veterinary Record

June 11th, 1938.

Bovine Contagious Abortion

IT will be generally agreed that bovine contagious abortion and its sequelae are of outstanding importance to the farmer and the cause of greater loss than any other single disease. It will also be agreed that no effort of appropriate magnitude is being made to deal with this disease. It has been suggested that the apathy of many farmers, regarding control by scientific methods, is such as to have at times raised doubts as to whether a national effort is justifiable. It will be found on examination, however, that this position is partly due to a lack of appreciation of the basic features of the disease and the means available for its control, and partly to an ever-present faith in so-called "cures," not one of which we have found to be of proven scientific value, but on which large sums are spent every year. All of this emphasises the need for more education of farming opinion in these matters, for it is certain that until we have an enlightened and enthusiastic farming opinion no extensive scheme of any kind is practicable. A *sine quâ non* is a unified veterinary opinion. This has been achieved in many other countries but it must be concluded from the recent discussion at the Central Veterinary Society that there is still much expressed difference of opinion here. The difference is probably more apparent than real and due to a confusion of two issues rather than a difference of opinion on either of them. Thus, it would be agreed by most that actual eradication by segregation of infected cows is an effective method of control but that it is one which is at present not applicable to a large proportion of British farms, and that therefore those newer methods of vaccination which appear likely to be satisfactory should be tested on a scale calculated to give a statistically satisfactory answer regarding their efficacy within a reasonable period.

It has been shown adequately that the method of control which is based on the separation of reactors and non-reactors to the agglutination test is effective and not unduly costly, and it should be emphasised in this connection that, whilst infected cows must be segregated when at liberty, they need not be eliminated. The method is the basis of State schemes of control in the United States of America, Canada, Germany, Norway and certain other countries of Europe. It has been the means of freeing a number of herds in this country.

Whilst the use of the dead vaccines at present available is uniformly recognised as valueless, and the use of living vaccine made from virulent strains is generally deprecated, it has been shown that by the use of a living vaccine made from a suitably attenuated strain, a state of resistance can be produced without permanent infection of the udder or body tissues such as has caused the condemnation of the use of virulent vaccines. It has also been shown that if vaccination is carried out during calfhood, *i.e.*, at a few months of age, the infection soon dies out but leaves a resistant state. An important point regarding these newer methods of vaccination is that, since the vaccination infection dies out, the animal soon ceases to react. Such vaccination need not, therefore, interfere with subsequent eradication by blood tests and indeed might well make it possible in herds in which it was in the first instance impracticable.

Much of this information has been available for ten years or more, yet no general effort to deal with the disease has been made, and the present position regarding abortion in this country is, therefore, a challenge to the veterinary profession and the farming community. We would put forward the view that control and eradication of the disease by the segregation of reactors should be put into operation wherever practicable and that vaccination should be strictly limited to those herds where it is impossible. We would urge the Government to provide some further incentive to the building up of clean herds. We are not unmindful of the aid they have promised in tuberculosis-free herds, but feel that a wider policy is required. Firstly, because in many herds it is necessary to eradicate abortion first and so ensure a supply of home bred stock before attempting to eradicate tuberculosis and, secondly, in view of the great loss from abortion itself. We would also urge that funds and facilities should be provided for testing further the value of vaccination with a strain of low virulence and of calf-hood vaccination on a really adequate scale, either by the vaccination of all animals in a given

area or by controlled experiments on a large number of farms.

For all of this we must have the enthusiastic support of farming opinion, and it is we as a profession who can do most to create it by private conversation and public lecture. In doing this we must be prepared to moderate our own particular views, at least in public, and submit to some regimentation of opinion in order that we may have common action.

CLINICAL COMMUNICATION

Dermoid Cyst

A. N. FOSTER, F.R.C.V.S.,
LINCOLN

Subject.—Black Labrador dog: about two years old.

The animal was brought for examination owing to the presence of a sinus in the right parotid region, the orifice being situated immediately behind the angle of the jaw, and from which there was a constant flow of thin, fluid, dirty yellowish discharge.

History. — In present owner's possession since three or four months old. Nothing abnormal noticed until a fortnight previously, when the discharge commenced and continued. General health remained good.

Examination.—A probe passed into the sinus showed it to extend upwards and backwards towards the base of the ear, for a distance of about 2½ inches. There was very definite thickening of the skin around the sinus track; it gave a cord-like feeling on palpation. The skin surface over the sinus was shiny and had the appearance and feel of scar tissue. The owner stated definitely that there had been neither injury to, nor previous operation in, the area concerned.

Diagnosis.—Dermoid or dentigerous cyst. Operative removal was recommended and a favourable prognosis was given.

The dog was admitted to the infirmary.

Treatment.—On February 12th, 1937, an injection of morphia was given. The hair having been removed and the skin disinfected, Novutox was injected at several sites in the involved area, narcosis and local anaesthesia thus being induced.

The sinus track was then dissected out, and was found to consist of a series of pockets of hair and involuted skin. The tissue was very dense and difficult to cut through. The whole of the cyst having been removed, and the wound cleaned up, the edges were brought together by means of interrupted silk sutures.

The wound healed by second intention; the edges required trimming two or three times during the healing process, as there was a tendency for them to curl inwards. By March 11th, 1937, healing was complete and the dog was discharged from the infirmary. There has not been any recurrence of the trouble.

It has been ascertained from the breeder that the parents of the dog and the remainder of the litter were normal in every way. The breeder was surprised when informed about the history of this puppy subsequent to the time he sold it.

ABSTRACTS

[The Subcutaneous Inoculation of Brucella-infected Milk into Different Species of Animals. (Trans. title.) CORDIER, G., and MENAGER, J. (1937.) *Rev. Méd. vét.* **89.** 580-588.]

Infected milk from a naturally infected cow was inoculated into guinea-pigs, rabbits, poultry, sheep, goats and a donkey. In guinea-pigs, three weeks after inoculation, agglutinins appeared and the titre rose regularly to 1:500 or more a month later. In other animals, the reaction to the organism was neither so regular nor so persistent. The guinea-pig, therefore, remains the animal of choice, both on economic and scientific grounds, for the determination of the presence of Brucella.

A. W. T.

* * * * *

[Enzoötic Virus Abortion in the Mare. SEDLMEIER. (1938.) *Münch. tierärztl. Wschr.* **89.** 4. 37-38.]

This is a preliminary report of an outbreak of abortion in mares which was probably due to a filtrable virus and resembled that first described in the United States by Dimock and Edwards in 1936, and in Germany, by Miessner and Harms, in the following year.

Six eight- to nine-months-old foetuses were examined, in each case abortion occurring without symptoms being shown by the mare either before or after the event.

The main findings in the aborted foetuses were: icterus, a large amount of fluid in all serous cavities, occasionally submiliary yellowish foci in the liver, enlargement of the spleen. Cultures made from various organs remained sterile. No bacteria or protozoa were found in smears. The mares' blood was negative to *S. abortus equi.*

Although no attempts to identify a virus were made it is considered that the clinical symptoms

and *post-mortem* findings are sufficient to identify the aetiology of the outbreak. The disease may be commencing to spread in Germany and plans for its rapid diagnosis and control are suggested.

E. G. W.

* * * * *

[A Multiple Pipetting Machine. Plastridge, W. N., and Williams, L. F. (1937.) *J. Lab. and Clin. Med.* **23.** 3. 318.]

A description of an electrically driven pipetting machine suitable for use in putting up agglutination tests for contagious abortion. It is claimed that the apparatus is not costly, is easily assembled by a mechanic and fills 140 tubes per minute.

E. J. P.

* * * * *

[Diagnostic and Surgical Treatment of Reticulo-peritonitis due to Foreign Body in Bovines. Noesen, P. (1938.) *Rec. Méd. vét. (Ecole d' Alfort).* **114.** 1. 14-34.]

Few will dispute the contention, inspired by perusal of the article under review, that the term "reticulo-peritonitis" is more exact than the commonly used English expression "traumatic gastritis" as a description of the lesions set up by penetration of the wall of the reticulum by certain foreign bodies.

The author reviews his experience of the condition and contends that 94 per cent. of gastric troubles in bovines are due to the ingestion and migration of foreign bodies. Whilst their ingestion generally causes no ill-effects in the male, gestation and parturition favour penetration of the tissues by suitable foreign bodies in the female. He points out that uncertainty of early diagnosis frequently prevents surgical interference, and that imperfection of technique often renders it abortive. The various types of foreign bodies capable of penetration, their progress in the tissues and the course of the condition are discussed in some detail, stress being laid on anatomical considerations, which are well illustrated by diagrams. The essential cause of penetration by a foreign body is stated to be the contraction of the reticulum, and the direction of travel is downwards and forwards across the floor of the reticulum in the majority of cases, more often to the left of the median line than to the right. Penetrations of the superior part of the anterior (diaphragmatic) wall and of the lateral wall of the reticulum are said to be very rare.

The condition is classified into the main types of acute and chronic—the former sub-divided into the "rapid-hyperaesthetic," the "ordinary" and the "hidden or suppressed" forms. In each the author gives useful practical aids to diagnosis based on experience and admits the difficulty encountered in many cases—a fact which is so often responsible for fatal delay or even failure to operate.

Surgical extraction of the foreign body being the only rational treatment, stress naturally is laid on technique. The opinion is expressed that affected fat stock and young animals should be slaughtered as well as cases which have progressed to the stage of traumatic peri- or myocarditis. The author operates on well-bred beasts required for breeding in all acute localised cases in which the pulse rate does not exceed 80 p.m. and where there is no systemic illness. In chronic cases of more than three weeks' standing the prognosis must always be doubtful but the operation is undertaken in cases where there is "everything to gain and nothing to lose."

The operation favoured is gastrotomy in the standing position under local anaesthesia and the technique is described in detail. Among the points of interest brought out is the ease with which a foreign body may be hidden in the reticular wall and the importance of thorough search; also the possibility of there being more than one foreign body. A systematic search of the reticulum—commencing on the left (point of spleen), thence across the floor (predilection seat) and anterior (diaphragmatic) face to the right (inferior border of the liver) is advocated. Mention is made of the fact that in some cases where an animal has not been seen to ruminate for one or two days prior to operation, his exploration of the reticulum has stimulated rumination which has continued throughout the operation. The author uses a sheet which is placed over the animal's back, with a slit or window corresponding with the operation wound and through which the rumen is drawn before incision. When closing the wound the mucous membrane of the rumen is not included in the sutures, and peritoneum and muscles are sutured together. If soiling occurs during the operation the lips of the rumen are sutured to muscle and skin and extra-peritoneal healing allowed. It is claimed that in 230 out of 250 cases operated upon, healing has been by first intention. The proportion of operation cases terminating fatally or in which destruction was resorted to is given as 4 per cent. only—a low figure, due, it is claimed, to early surgical interference. Cows and heifers have been operated upon eight, four and two days before parturition, whilst others had passed full term at the time of operation. Amongst animals successfully treated were cows and heifers which have subsequently calved normally from three to six times.

At one time the author abandoned gastrotomy in the standing position in favour of median abdominal incision in the dorsal position—a rational procedure as it permits treatment of the lesions caused by the foreign body as well

as removal. In view of certain defects, however, he has now reverted to gastrotomy in the standing position for all ordinary cases, confining abdominal section to special cases such as complete penetration into the peritoneal cavity, localised peritonitis with much fluid exudate, retro-diaphragmatic abscess, etc. In these cases a drainage tube is inserted and left in position for 10 to 15 days.

F. W. W.

* * * * *

[Rupture of the Posterior Vena Cava in a Cavalry Horse. Garbe, W. (1938.) *Deuts. tierärztl. Wschr.* **46.** 9. 133-135.]

Rupture of veins appears to be most common in military horses.

During 42 years 144 cases of rupture of a vein are recorded in statistics of the German Army Veterinary Corps, out of a total of 1,832,269 diseased horses. Of these cases 45 occurred in the posterior vena cava, 26 in the anterior vena cava, eleven in the pulmonary, ten in the portal, nine in the jugular, six in the coronary or renal veins and 37 in other veins.

The exciting cause of rupture of a vein is undoubtedly a sudden rise in blood pressure, as all cases recorded occurred after jumping, galloping, a sudden fright, etc. It is doubtful whether spontaneous rupture ever took place without some previous weakening of the wall of the vessel. *Post-mortem* findings always show a lacerated edge to the rupture and the neighbouring tissue is infiltrated with blood.

In the case recorded the horse had been ridden for an hour and was put over two jumps. It collapsed after the second jump and died in a few minutes. *Post-mortem* examination revealed a 4 c.cm. long rupture of the posterior vena cava, posterior to the right kidney, and a small rupture 1½ cm. close beside it. The edges of the rupture were swollen and infiltrated with blood. On the inside of the vein a rupture of the intima alone, 1 cm. long, was also present.

When examined histologically liver tissue was found to be present in the swollen area around the rupture, showing that the predisposing cause in this case was misplacement of embryonic tissue.

A. T. P.

* * * * *

[Adamantinoma in the Lower Jaw of a Horse. Wahl. (1938.) *Deuts. tierärztl. Wschr.* **46.** 8. 113-117.]

An adamantinoma is an epithelial tumour arising from enamel tissue, and a knowledge of the development of all dental tissues is necessary to understand its nature.

Thirteen cases are recorded—ten in cattle, two in cats and one in the horse. An adamantinoma is usually situated within the aveolus of the lower incisors. Its growth is expansive and distends the alveolar border, extending either into the mandible, or into the cavity of the mouth. It varies greatly in size, and may be solid or cystic. It is irregular in shape, hard and elastic in consistence, with possibly soft areas, reddish grey in colour and always has an epithelial capsule. Histological examination reveals a superficial layer of unevenly distributed bone surrounding an area of strands and masses of epithelial cells. In cystic cases the centre is hollowed out and contains a clear slimy fluid.

The specific case recorded occurred in a ten-year-old gelding. The initial growth was between the middle and centre incisors of the left side of the jaw, but in six months it had involved the whole area surrounding the left canine and the three incisor teeth. It was quite hard except for a small soft area on the labial surface of the mandible. An elliptical portion of the mucous membrane over this soft area was removed and the fluid underneath released by puncture. The whole structure of the tumour was then broken down and removed by curetting, probing and the use of bone forceps, until only a shell of compact bone remained. Healing did not follow but the wound filled again with tumour formation, this time not cystic. After two months this tumour was removed, in the same way as in the first operation. Healing occurred slowly by granulation, after which the horse could eat well and was fit for work.

C. W. O.

AUSTRALIAN THREE-DAY CATTLE DISEASE

The Melbourne correspondent of the *Times*, in a message to his paper, dated May 27th, states that Professor H. R. Seddon, who holds the Chair of Veterinary Science in Brisbane University, told the Australian Veterinary Science Congress that painstaking research has shown that an unknown winged insect must be the cause of the new cattle disease known as three-day sickness. This disease is so serious that, although it soon passes, when herds are affected dairymen have to buy tinned milk for their own use.

The insect (said Professor Seddon) must have reached the north-west of Northern Australia in February, 1936, whence the disease was spread from infected beasts by indigenous insects presumably carried by the wind through Queensland, New South Wales, and, to some extent, Victoria.

Professor Seddon regretted, from the point of view of research, that the disease has temporarily died out and so upset comprehensive plans to determine the carrier insect.

The conference was also told of the results of experiments made by the Council for Scientific and Industrial Research with a vaccine prepared from the germ of pleuro-pneumonia, which gives cattle immunity for a year at least. More than 600,000 doses have been used in Queensland and the Northern Territory in the past three years.

REPORT

[A Report on an Outbreak of Food Poisoning due to Salmonella, Type "Dublin" and Conveyed by Raw Milk. Conybeare, E. T., and Thornton, L. H. D. (1938.) Reports on Public Health and Medical Subjects. No. 82.]

About a hundred children who drank a particular supply of raw milk on October 28th and 29th, 1936, developed, 12 to 24 hours afterwards, a temperature between 99° F. and 103° F., headache and nausea followed by vomiting which was severe but of short duration; later there was diarrhoea with watery stools which did not contain blood. No deaths occurred.

Unfortunately, specimens of faeces were not examined till six days later, when convalescence was well established, and they were then negative by bacteriological tests. From a specimen of milk delivered on the second day and from milk supplied by the same producer four days later, there was isolated a Dublin type of Salmonella (*S. enteritidis* var. Dublin). The sera of nine convalescents agglutinated a suspension of the organism at titres of from 1:600 to 1:2500.

An inspection of the mechanical milking plant in use suggested that as a result of certain defects in the technique of operation the milk might easily have become contaminated with cow dung. An examination of the sera of 51 cows of the herd showed that three had an agglutinin content for the "H" antigens of the Dublin type from 1:400 to 1:800, whilst the remainder were either negative or agglutinated the organism to 1:25 only. The three cows showing the high agglutinin content had not appeared ill and were giving apparently normal milk. Specimens of milk and dung were obtained on three occasions from each of these cows and one cow was shown to be excreting large numbers of the Dublin type of Salmonella in the faeces every time. The faeces of the other two cows, and the milk of all three, were negative.

After this cow had been removed from the herd and certain alterations had been made in the mode of operation of the mechanical milking plant, samples of the bulk milk produced by the herd were examined daily for six weeks and were negative as regards the presence of the Dublin type of Salmonella.

Several interesting points emerge from this report, the first concerning the type of infecting organism and its bovine source. Although the Dublin type was not differentiated from *S. enteritidis* till 1929, Smith and Scott[1] showed that many old strains labelled *S. enteritidis* were really the Dublin type and that in most cases in which the organism had been isolated from man, milk was suspected as the vehicle of infection. Furthermore, strains of the so-called "paracolon" bacilli isolated from calf dysentery in Denmark were also of the Dublin type, and it was therefore suggested that the Dublin type was of bovine habitat. Since that date there are records of the isolation of the Dublin type of Salmonella from calves in many countries; in Great Britain by Bosworth and Lovell,[2] in Kenya by Daubney,[3] in India by Shirlaw,[4] and in South Africa by Henning (unpublished). There is apparently less information available concerning healthy adult cows which carry this bacillus, and unfortunately there are no details of any experiments made to find out how long this cow continued to excrete it.

A second point concerns the presence of agglutinins for *S. enteritidis* var. Dublin in the sera of about 50 per cent. of the cows. The titres—apart from three cows—were 1:25 and similar reactions were found in the sera of some of 71 cows from another herd, and the statement is made that "It was considered that a titre of 1:25 was a non-specific reaction due to previous infection by homologous Salmonellas." The presence of these normal or natural agglutinins in bovine and other sera is well known, and in 1926, Kinloch, Taylor and Smith[5] suggested that they were due to previous infection with homologous bacteria. Evidence is accumulating which tends to refute this; it was suggested in 1934 by Lovell[6] that these agglutinins are due to stimulation by bacteria or substances unrelated in the systematic sense but having some slight antigenic similarity. This view recently received confirmation, for Ingalls[7] has shown in rabbits that the presence of a specific enterococcus in the intestines is associated with antibodies to Shiga's dysentery bacillus in the sera. The presence in the sera of antibodies for a particular organism is, therefore, not necessarily due to previous infection with that organism, and there is as yet no evidence to modify the attitude taken up by Savage[8] that Salmonella bacteria are not found more frequently—that is, in animals used for food—than can be accounted for on the supposition that their presence is due to an actual case of disease or the carrier state after infection.

Other points of interest concern the advice given in the report that in food poisoning outbreaks connected with milk or milk products the possibility of an animal vector should be considered and veterinary co-operation sought, so that the question of infection from a bovine source might be promptly investigated. The outbreak is compared with several others due to infected raw milk, *e.g.*, the Brighton and Hove outbreak of septic sore throat affecting

1,000 families, in which 65 deaths occurred in 1929; the Epping outbreak of paratyphoid B fever in 1931, with over 260 cases; the Chelmsford outbreak of scarlet fever and sore throat, with 1,600 cases, in 1935; the Bournemouth outbreak of typhoid fever, with over 500 cases and 51 deaths, in 1936; and the Doncaster outbreak of scarlet fever and sore throat in 1936-37, comprising some 314 cases. In all the above outbreaks, the milk supply to which the infection was traced had passed routine bacteriological standards for cleanliness. It is, therefore, of moment that in the prefatory note to this report the Chief Medical Officer states that a clean raw milk is not necessarily a safe milk and that no amount of care in milking and distribution of raw milk can entirely prevent it from being a danger to the consumer. The only practicable way to reduce the risk of such outbreaks to a minimum is by efficient pasteurization, or by some other suitable form of heat treatment, and recent investigations in calves[9, 10] provide further evidence that there is no significant difference in nutritive value between raw and pasteurized milk.

R. L.

References

[1]Smith and Scott. (1930.) *J. Hyg.* 30. 32.
[2]Bosworth and Lovell. (1931.) Univ. Camb. Inst. Animal Path. Second report. 21.
[3]Daubney. (1934.) 12th Int. Vet. Congress. Vol. 2. 279.
[4]Shirlaw. (1935.) *Ind. Jour. Vet. Sci.* 5. 262.
[5]Kinloch, Smith and Taylor. (1926.) *Jour. Hyg.* 25. 434.
[6]Lovell. (1934.) *Jour. comp. Path. and Ther.* 47. 107.
[7]Ingalls. (1937.) *Jour. Immun.* 33. 123.
[8]Savage. (1920.) Food Poisoning and Food Infection. Cambridge.
[9]Wilson, Minett and Carling. (1937.) *Jour. Hyg.* 37. 243.
[10]Wilkie, Edwards, Fowler and Wright. (1937.) *Jour. Dairy Research.* 8. 312.

University of London: Second Examination in Veterinary Science

The Regulations for the University of London, Second Examination in Veterinary Science, Part II, have been amended by the insertion of the following after the first paragraph: "A candidate who has been referred in one subject only at the First Examination in Veterinary Science in July or December and passes in that subject at the next following First Examination in Veterinary Science will be permitted to proceed to the Second Examination in Veterinary Science, Part II, as though he had completed the First Examination in Veterinary Science in July or December respectively, provided that he has completed the prescribed course of study."

REVIEW

[**Rancidity in Edible Fats.** By C. H. Lea, B.Sc., Ph.D. (Low Temperature Research Station, Cambridge). Food Investigation Special Report No. 46 of the Department of Scientific and Industrial Research. Price 3s. 6d.*]

The study of the changes occurring in edible fats is a many-sided problem requiring a knowledge of the nature of the fats themselves, of the many agencies which may bring about their breakdown, of the types of this breakdown, and of the various conditions affecting its rate. On all these questions much work has been carried out during recent years and the omission of some of this recent knowledge from a review produced at such low cost as the present report might be excused. Dr. Lea has, however, dealt with the subject comprehensively and authoritatively and every recent addition to the subject appears to find a place in the text, or if subsequent to writing, as an occasional added footnote.

The story unfolded is indeed a fascinating one and one full of interest to the veterinarian engaged in public health work or animal nutrition.

The work is divided into five parts. The first is devoted to the chemistry of the fats, their occurrence in vegetable and animal tissues, their digestibility, factors which influence the composition of fats as laid down in living organisms and the presence of such products as sterols and vitamins, in the unsaponifiable fraction of the fat. In this chapter many facts interesting to the veterinarian are given, such as the preliminary result showing that the inclusion of cod liver oil in the diet, even in small quantity, markedly increases the susceptibility to oxidation of the body fat laid down. The composition of the fats of butter from different breeds of cattle is discussed and such points as the production of soft butters from cattle fed on fresh pasture and of hard butters from winter diets of roots, hay, silage, coconut or palm-kernel cake and oil cake meals of low fat content are made. This chapter contains much information that would not ordinarily be found under the general heading of the chemistry of fats.

The second part briefly describes the many changes that can be grouped under the term rancidity and Part 3 deals with the lesser

*Copies can be purchased directly from H.M. Stationery Office at the following addresses: Adastral House, Kingsway, London, W.C.2; 120, George Street, Edinburgh, 2; 26, York Street, Manchester, 1; 1, St. Andrew's Crescent, Cardiff; 80, Chichester Street, Belfast; or through any bookseller.

causes such as the absorption of odours, the action of enzymes and the presence of free fatty acids. In Part 4, a reasonably full account is given of the action of micro-organisms on fat and of the methods adopted of reducing spoilage from these causes.

The fullest part of the report is that dealing with the deterioration of fats by atmospheric oxidation; a subject treated from every point of view. The many changes which occur in fats as the result of oxidation are examined individually and their part in the general onset of rancidity is discussed. The influence of light, temperature, traces of metals, ozone, peroxides and enzymes upon the onset of rancidity is clearly brought out and the action of various inhibitors described. The yellowing of natural fats, the production of "fishiness," tallowy flavour and other off-signs are further problems which receive attention.

A final part describing rancidity in dairy products and in the fat of meat seals the appeal of the book to the veterinarian. Here milk, dried milk, butter, meat—including frozen beef and lamb, pork, chickens, rabbits, bacon and chilled beef—and fish are all examined from the point of view of the onset of rancidity, its causes and the methods of slowing it down.

The book contains a fair amount of chemistry but practically all of this should be easily followed by the veterinarian. A far greater proportion of the book is made up of a discussion of the innumerable biological factors and problems involved in this story of fat and this makes it a volume well worth purchasing even by those whose knowledge of chemistry is meagre. We cannot do less than welcome the report with pleasure and recommend its perusal, and in fact purchase, to all those interested in foods and nutrition.

In Parliament

Food and Drugs Bill

In the House of Commons on May 31st, the report from the Joint Committee of the House of Lords and House of Commons, with minutes of evidence, in respect of the Food and Drugs Bill (pending in the Lords) was brought up and read. Report to lie upon the Table, and to be printed. [No. 125.]

. . . . . .

The following are among the questions and answers recorded in the House of Commons recently:—

Infectious Disease (Milk-Borne Outbreaks)

Mr. Liddall asked the Minister of Health what epidemics of infectious disease have been attributed to spread by milk during the five years 1933-37 in England and Wales; how many cases were involved and how many deaths resulted; and what steps he has taken to prevent a recurrence of such milk-borne outbreaks?

Mr. Bernays: Following is the answer to the first and second parts of the question:—

With regard to the last part of the question, it would not, I fear, be possible to give a full reply within the limits of a Parliamentary question and answer, but I would call my hon. Friend's attention to various measures such as the Agriculture Act, 1937, and the vigorous supervision of milk supplies by medical officers of health.

. . . . . .

Milk Supply, Angus

Mr. Westwood asked the Secretary of State for Scotland whether he is aware that the medical officer of health for the county of Angus reported that last quarter six cows were slaughtered out of registered dairies; that only one cow was reported to the authority by the owner; that out of the six cows five were cases of advanced tuberculosis; that after the owner of one dairy had been struck off the list of registered dairies the Milk Marketing Board continued to purchase diseased milk from him; and what action does he propose to enforce the purchasing of pure milk by the Milk Marketing Board?

Mr. Colville: I have seen the report to which the hon. Member refers. I understand that even

Epidemics of Milk-borne Disease 1933-1937.

Place.	Year.	Disease.	Notifications.	Deaths.
Hyde	1933	Scarlet Fever	43	4
W. Hartlepool	1933	Paratyphoid B. ...	24	1
Epping U.D. and R.D....	1933	Paratyphoid B. ...	22	None.
Chelmsford B. and R.D.	1935	Scarlet Fever	487	6
Eton R.D.	1935	Scarlet Fever	100	2
Kettering U.D. and surrounding district.	1936	Enteric (Cream cakes thought to be vehicle).	9 cases in U.D. and 23 in [redacted] District.	1 death among the 9 U.D. cases. Deaths in District not stated.
Bournemouth, Poole and Christchurch.	1936	Enteric	718 [redacted]	51 among the residents. No information as to visitors.
Doncaster	1936	Scarlet Fever and Tonsillitis.	135 cases of Scarlet Fever, 229 "Sore throat."	2 deaths "definitely associated with the outbreak."
Wilton (Wilts.)	1936	Gastro-enteritis ...	About 100 (disease not notifiable).	None.

advanced tuberculosis in cows can frequently be discovered only on careful veterinary inspection, and in accordance with statutory requirements frequent veterinary inspection of all dairy herds is made. With reference to the last two parts of the question, the dairy referred to had been struck off the register on account of its structural condition, not because cows in it were diseased, and as my hon. Friend informed the hon. Member last week the Milk Marketing Board have now ceased to accept milk from it.

Mr. Westwood: Is the right hon. Gentleman satisfied that careful veterinary inspection has taken place in the county of Angus?

Mr. Colville: The hon. Member will probably be aware that the recent Tuberculosis Order, 1938, requires a dairyman to notify a police constable or veterinary inspector if any of his cows are affected by a chronic cough or show signs of tuberculosis. I hope that that will help the administration.

Mr. Westwood: Is the right hon. Gentleman aware that only one dairyman reported in connection with one of these cows, and what action is to be taken against the other five dairymen who did not report cases of this kind?

Mr. Colville: The Order to which I refer is a very recent one, and I hope it will produce very good results.

. . . . .

Dogs (Export)

Mr. T. Williams asked the Minister of Agriculture which body is authorised to grant an export licence for a dog; the cost of such licence and the conditions on which it is granted; and will he state the terms and conditions on which a dog may be exported to the United States of America where no licence has been issued?

Mr. W. S. Morrison: No licence is required for the export of a dog from Great Britain unless the animal at the time of the proposed exportation is undergoing quarantine on account of its having been imported from abroad. In such a case a licence is granted by the Ministry of Agriculture and Fisheries without fee, subject to the conditions that the dog shall be transported to the vessel in a suitable crate by an approved carrying agent, who is required to report to the Ministry the arrival of the dog on the vessel. I understand that no regulations of a veterinary character are in force controlling the importation of dogs into the United States, except that dogs intended for use in the handling of livestock are quarantined for a sufficient time to determine their freedom from the tape-worm. With certain exceptions a 15 per cent. *ad valorem* duty is payable.

Mr. Williams: When the owner of a dog secures a registration certificate, are the terms of import to the United States or Canada insisted upon?

Mr. Morrison: I should require notice of that.

A small box containing narcotic pills recently fell from the windowsill of a house at Eger, Czechoslovakia. Hens in the courtyard of the house found them and ate them up. The birds immediately fell asleep and did not awaken until four days later, when they seemed none the worse.—*Exchange.*

ROYAL COLLEGE OF VETERINARY SURGEONS

Membership Examinations, 1938

LIST OF SUCCESSFUL CANDIDATES

ANIMAL MANAGEMENT

(*Continued from page* 690.)

Dublin

Bourke, S. E.
Bowen, L. T.
Brown, C. C. B.
Burns, N. M.
Carlisle, J. (credit)
Collins, W. C.
Davison, W. F. (credit)
Dodd, A. M.
Donnelly, A. D.
Gallagher, M. A.
Good, N. S.
Htwe, San
Hunter, W. M. D.
Hutch, Liam (credit)
Kane, G. J.
Kavanagh, S.
Kinsella, L. K.
Lynch, T. J. (credit)
McConnell, J. W. (credit)
McVeigh, D.
Mahony, J. I. (credit)
Offord, E. C.
Parkhill, Miss M. E.
Quin, B. J. (credit)
Thompson, T. W. (credit)
Wallace, J. G.
Whitty, B. T.
Yasin, S. A.

Glasgow

Anderson, A. C.
Aupret, David
Bhal, P. N. (credit)
Bhardwaj, V. R.
Black, W. W.
Brown, R. A.
Callum, R. H. B.
Caldwell, W. A.
Cassells, J. (credit)
Corsan, Miss M. I.
Crosbie, Andrew (credit)
Darroch, W.
Douglas, J. C.
Douglas, Robert
Edwards, J. R. (credit)
Evans, R. P.
Forbes, D. A.
Frith, H.
Gilmour, J. M.
Grey, J. R.
Harris, G. W.
Higgins, Archd.
Johnston, Adam
Johnston, W. G.
Juneja, G. C. (credit)
Kinney, J. A. H. (credit)
Lauder, I. M. (credit)
Lennie, Miss M. B.
Lewis, A. C.
Loughlin, J.
MacInnes, D. I.
Mackay, Angus
Mackay, J. R.
Mackenzie, G. A.
Mackinnon, I. J.
McLauchlan, D.
Munro, D. W. J.
Muir, R.
Naismith, J. A. A.
Paterson, A. B. (credit)
Peoples, J.
Pomphrey, A. M.
Samuel, Miss M. I.
Semple, W. (credit)
Stewart, Miss F. E. H.
Sutherland, W. R.
Swanney, J. M.
Taylor, J. M.
Wilson, J. C.
Wilson, Robert
Young, James

Notes and News

The Editor will be glad to receive items of professional interest for inclusion in these columns.

Diary of Events

June 15th.—Meeting of the Western Counties Division, N.V.M.A., at Launceston, 2 p.m.

June 16th.—Meeting of the Midland Counties Division, N.V.M.A., at Birmingham, 12.30 p.m.

June 17th.—Annual Summer Meeting of the Lancashire Division, N.V.M.A., at Southport, 12.30 p.m.

June 17th.—General and Annual Summer Meeting of the Lancashire Division, N.V.M.A., at Southport, 12.30 p.m.

June 22nd & 23rd.—R.C.V.S. Committee Meetings.

June 24th.—R.C.V.S. Committee and Council Meetings.

June 30th & July 1st.—R.C.V.S. written examinations.

July 4th.—Meeting of the Editorial Committee, N.V.M.A., at 36, Gordon Square, W.C.1, 4 p.m.

July 11th & 12th.—N.V.M.A. Council and Committee Meetings, Royal (Dick) Veterinary College, Edinburgh.

Aug. 21st-25th.—Thirteenth International Veterinary Congress, Zürich.

Aug. 26th-27th.—Thirteenth International Veterinary Congress, Interlaken.

Sept. 5th-9th.—Annual Congress, N.V.M.A., at Glasgow.

* * * * *

Veterinary Council (Eire)

At a meeting of the Veterinary Council (Eire) held on June 1st, 1938, Mr. P. F. Dolan, as Returning Officer, reported that at the Council Elections, held on May 27th, he had declared Mr. A. A. Donnelly elected as General Elected Member for four years, and Mr. J. J. Condon as Limited Elected Member also for a period of four years.

The following committees were appointed:—

Standing and Penal Cases Committee.—Mr. A. A. Donnelly, Professor J. J. O'Connor and Mr. P. F. Dolan, President.

Finance Committee.—Mr. A. A. Donnelly, Professor J. J. O'Connor and Mr. P. F. Dolan, President.

* * * * *

PERSONAL

The King's Levée.—On the occasion of the Levée held by the King at St. James's Palace on June 1st, Professor Sir Frederick Hobday, C.M.G., F.R.C.V.S., F.R.S.E., Professor Emeritus and Past Principal of the Royal Veterinary College, London, was presented to His Majesty, on receiving the Honour of Knighthood, by Colonel Sir Arthur Erskine, G.C.V.O., D.S.O.

. . . . .

The Birthday Honours.—In the list of birthday honours conferred by the King, issued on Thursday last, announcement is made, in the Colonial Office List, of the award of the C.B.E. (Order of the British Empire, Civil Division) to William Walker Henderson, Esq., M.R.C.V.S., D.V.S.M., Director of Veterinary Services, Nigeria, while in the Dominion Services List, Arthur William Turner, Esq., D.Sc., D.V.Sc., Senior Bacteriologist, Animal Health Division, Council for Scientific and Industrial Research, Commonwealth of Australia, is awarded the O.B.E. (Order of the British Empire, Civil Division).

. . . . .

Marriage.—Halford—Andersen. At St. Mary's Church, Monkseaton, Northumberland, on Monday, May 23rd, 1938, by the Rev. James Grovenor Halford, M.A. (father of the bridegroom), Vicar of St. Luke's, Leek, Staffs, Godfrey James Grovenor Halford, M.R.C.V.S., D.V.S.M. (Vict.), to Olive Amelia Isobel, daughter of the late Mr. Niels Christian Andersen, and of Mrs. Isabella Andersen, 16, Monkseaton Drive, Whitley Bay.

. . . . .

Will.—Ogden, Mr. George Oscar, M.R.C.V.S., of Eastbourne (net personalty £11,132) £11,698.

* * * * *

R.C.V.S. OBITUARY

Littler, Justus, 59, Station Road, Oakham, Rutland. Graduated Edinburgh, April 17th, 1873. Died May 21st, 1938; aged 85 years.

Mr. Justus Littler, M.R.C.V.S., who may be described as a remarkable and well-known Oakhamian, died from complications arising as a result of a fractured thigh, sustained six months previously.

Born at Long Clawson, Mr. Littler went to Oakham as a veterinary surgeon over 60 years ago. He was the last remaining member of a well-known Melton Mowbray district family, his only sister dying seven weeks ago at Long Clawson.

When a younger man Mr. Littler hunted regularly with the Cottesmore. He gained a reputation as an entertaining conversationalist.

Hundreds of visitors to Oakham have seen the hedge cut in the shape of a horse in a field near Mr. Littler's home. Actually a maid first designed the hedge, but Mr. Littler had kept it in shape ever since.

His wife, who is 88, is also suffering from an injured thigh, but is recovering. There is no family.

A large company attended the funeral service at Oakham Church, conducted by the Vicar, the Rev. C. O. R. Wormald.

. . . . .

Paterson, Joseph, 8, Market Square, Horncastle, Lincs. Graduated Glasgow, December 22nd, 1897. Died May 30th, 1938; aged 74 years.

* * * * *

AGRICULTURAL RESEARCH COUNCIL

Sir Thomas Middleton Appointed Chairman

The committee of the Privy Council for the Organisation and Development of Agricultural Research, after consultation with the members of the Agricultural Research Council and the President of the Royal Society, have appointed Sir Thomas H. Middleton, K.C.I.E., K.B.E., C.B., LL.D., D.Sc., F.R.S., to be Chairman of the Agricultural Research Council with effect from July 1st, 1938. On that date the Right Hon. Lord Richard Cavendish, C.B., C.M.G., who has been Chairman of the Council since its inception in June, 1931, retires from membership of the Council under the rota of retirement determined by the committee of the Privy Council.

[Sir Thomas Middleton, who is Vice-Chairman of the Development Commission, an office which he has held since 1929, has been a member of the Agricultural Research Council since its establishment in 1931. He is Chairman of the Standing Committee of the Council on Soils and Plant Nutrition and of the committee on the Estimates of Research Institutions. Sir Thomas was educated at Merchiston Castle School, Edinburgh, and at Glasgow and Edinburgh Universities. He was successively Professor of Agriculture in Baroda College, India, Lecturer in Agriculture at the University College of Wales, Aberystwyth, Professor of Agriculture in Durham College of Science, and Professor of Agriculture at Cambridge. In 1906 he joined the staff of the Board of Agriculture and Fisheries as Assistant Secretary, and from 1917-19 was Deputy Director-General of the Food Production Department. Sir Thomas Middleton was a member of the Royal Commission on Agriculture in India, which sat from 1926-28. He was the first recipient of the Gold Medal of the Royal Agricultural Society of England, awarded for services to agriculture.]

* * * * *

LONDON CART HORSE PARADE

Regent's Park is recognised nowadays as the Mecca of the horse-loving Londoner on holiday and once again, on Whit-Monday, the annual (forty-eighth) parade of the London Cart Horse Parade Society drew large crowds there to admire the best turned-out cart horses within the Metropolitan Police area. There were 574 animals driven by 507 drivers. The numbers are, however, gradually shrinking. Just after the War there were over 1,000 entries, and in 1930 there were 876. During the two-and-a-quarter hours of the afternoon occupied by the prize distribution and "march past" of nearly 600 vehicles, however, the whole of the route in the Inner Circle of the Park was packed with spectators; and in the morning as the vehicles moved slowly towards the judges' enclosure, it was at times impossible to make any progress through the crowd of admirers.

The objects of the Society are to improve the general condition and treatment of London's cart horses, to encourage drivers to take a humane interest in the animals under their care, and to encourage also the use of powerful cart horses for heavy work in the London streets. In awarding prizes the turnout of horse, van, harness and general appearance, together with the nature of the trade of the competitor, are taken into consideration.

Whit-Monday's parade was notable for the number of years' service of competitors with the same employers. The Isabel Constable Prize of £3 10s. 0d. was awarded to William Ambridge, with 47 years in the employment of Dunbar Wharf, Limited. Six prizes went to drivers of from 44 down to 40 years' service, while 25 had 30 years or over.

Sir Walter Gilbey thanked Lady Moore, wife of Sir Thomas Moore, M.P., a member of the committee, for presenting the awards, and then spoke of the wonderful condition of the horses seen that afternoon. There were not so many to-day, but that could not be expected with the mechanised mind of the community. But it had been demonstrated that the horse was essential to the business of the country, and while they were anxious to help the Ministry of Transport to conduct the traffic of London, he hoped there would be equity and fairness towards the horse. Tens of thousands in the Metropolis were entirely dependent for their livelihood on horse traffic. He assured his hearers that the horse would never be extinguished. The younger generation were found of riding, and to-day there were more children riding than at any time in the history of the country. They in turn would carry on the tradition as, he concluded, "we older men have done in the past."

* * * * *

ARMY VETERINARY SERVICE

London Gazette—War Office—Territorial Army

June 3rd.—Lieut.-Colonel J. S. Bowden, O.B.E., T.D., having attained the age limit, retires and retains his rank, with permission to wear the prescribed uniform (June 4th).

* * * * *

LEGAL NOTES

Licensing of Bulls Act Offence.—For failing to obey Ministry of Agriculture notices to castrate or kill two bulls, Robert W. Churchill, of Hooley Farm, Coulsdon, Surrey, was recently fined £5 on each summons at Croydon. Five guineas costs brought the total to £15 5s. 0d. The proceedings were taken under the Improvement of Livestock (Licensing of Bulls) Act, 1931.

Mr. H. E. James, for the Ministry, said the object of the Act was to prevent injury to the livestock of the country by low standard breeding. At ten months every bull had to be examined as to its fitness for breeding. If passed, it was permanently marked accordingly on the ear and numbered; if rejected, it was stamped with a large "R" and number, and the owner was served with a notice requiring slaughter or castration within a given period. The maximum penalty if this were not done, was £3 a day so long as the failure continued.

In September, Mr. James continued, defendant applied to have two bulls licensed. On October 8th, Mr. Brindle Wood, Livestock Officer for Surrey, inspected them. One, which might have been a mixture of Friesian, Shorthorn and Welsh Black, was a thoroughly bad specimen; the other not much better. Both were rejected, and Mr. Churchill apparently had not expected them to pass. He did not avail himself of the means of appealing against the officer's decision. Notice to slaughter or castrate the animals by December 31st was served, supplemented by letters of which defendant took no notice. Calling again on March 8th, Mr. Wood found that nothing had been done. Defendant said he had spoken to two veterinary surgeons, but thought it more reasonable if the Ministry were to send their own men to do the work. He was warned of the penalties and of possible prosecution, of which he said he was quite aware. He had, in fact, mentioned the matter to veterinary surgeons, but apparently not very forcibly—not really making it clear that he wanted them to attend and do the work. On March 14th he was given a further seven days' notice, or failure to comply with which proceedings would be considered. On April 7th, however, Mr. Wood found defendant still awaiting the veterinary surgeons, and it was not until May 2nd that the alternative to slaughter was carried out. Mr. James pointed out that defendant had given a lot of unnecessary trouble to public officials, having for four months kept animals in a condition to create the damage which it was the object of the Act to obviate.

Defendant assured the court that the bulls had been kept quite apart from other cattle. He now

sincerely regretted not having complied earlier with the notices. He spoke to a veterinary surgeon in January, and he said that the work should be done in reasonably good weather, and at that time the weather was not suitable.

The Chairman, in giving the decision of the magistrates, said that the defendant had been very negligent. "These orders," he added, "are not made for the fun of the thing. It is an important question for the country at the present time. You have only yourself to blame for being in this position."

* * * * *

Erratum.—On page 687 (column 1) of our last issue, under the heading "Interesting Cases," it is stated that Mr. S. E. Holmes reported that he had found that the race-horse Ego had a ruptured right ventricle: this should read "with hypertrophy of the right ventricle."

* * * * *

H.M. STATIONERY OFFICE PUBLICATIONS

The undermentioned has been published recently. Copies can be purchased through any bookseller, or directly from H.M. Stationery Office, at the following addresses: London: Adastral House, Kingsway, W.C.2, and 28, Abingdon Street, S.W.1: Cardiff: 1, St. Andrew's Crescent; Manchester: York Street; Edinburgh: 120, George Street.

	Price net s. d.	*Post free* s. d.
House of Lords Papers and Bills:—		
(118). Food and Drugs Bill. (H.L.). As amended by the Joint Committee	1 6	1 8

* * * * *

WHAT WE OWE TO ANIMALS

Sir Frederick Hobday, C.M.G., F.R.C.V.S., in an address on the above subject at a recent luncheon of the New Health Club, spoke under the respective headings of "What we owe to animals from our point of view," and, "What we owe to them from theirs."

"When considering our own point of view," said Sir Frederick, in the course of this address, which is reproduced in the May issue of *New Health*, "I take it that we have to be practical as well as sentimental; and that by taking a reasonable, common-sense point of view we are not only doing the 'greatest good to the greatest number,' but we are acting in the only possible way which will bring a good result.

"Men and women have always been the controllers of the destinies of the animal world, and because they are proud to be considered as such they unavoidably take upon themselves considerable responsibility. Mankind has a duty to perform to animals, and in this we must not fail; moreover, it must not be forgotten that animals have rights, and that public conscience has from time to time been awakened to this fact, and has had these rights embodied into legal form in the shape of Acts of Parliament.

"Sometimes these Acts become dormant, and in some countries they are so seldom enforced that many of them have become practically a dead letter, but in England there are—and always have been—people willing to fight against cruelty, so that there is always a war of attrition being waged against anything of this kind; and this country is looked upon as the pioneer. We must not, however, think that we hold a monopoly in this respect, as other countries have followed close in our wake, and sometimes have led the van. In Holland, for example, the laws regulating the humane slaughtering of animals for food were for many years ahead of ours, and by law every animal killed for the food of man was stunned to insensibility before the knife was used on the throat; whereas in England it is only some four or five years ago that the semblance of such a law was put on the Statute Book, and even then it was most curiously crippled in regard to its full effect because the sheep—the most meek and helpless of all the food animals, and the one whose slaughterhouse numbers exceed those of any other, was not included—this animal is still killed in the old way. The Bill has been defeated three times, and those who had this Humane Slaughter Bill at heart were definitely given to understand that if they persisted in including the sheep there would be so much opposition that the Bill would be lost again. To remedy this curious anomaly the various animal humane societies have agreed upon a general plan to send representatives to the various authorities who control district slaughterhouses to endeavour, by persuasion, to get the word "may" altered to "shall," so that the bye-law would then read "shall" be rendered unconscious before the knife is used on the throat, instead of "may" be rendered unconscious, and now there are only some 515 municipal or rural authorities left who have not come into line—truly 515 too many, but we have hope that they too will shortly see as we wish them to see, and come into line with the others. . . .

"The Cruelty to Animals Act of 1849 was the first important statute on the point, and this protected all domesticated animals, each of which is specifically mentioned by name; but it did not include wild animals, which could still be maltreated with impunity. It was not until 1900 that a second Act was passed called the Wild Animals in Captivity (Protection) Act, 1900, and this included all other animals not protected in the 1849 Act—together with birds, fish and reptiles.

"This was a great advance, but nothing more than what we owe to animals—whether domesticated or wild—when they come under our care. But even with these two Acts the law is not complete, as neither of them applies to wild animals not in captivity or close confinement. For example, a whale which is left stranded on a beach by a receding tide may be horribly multilated without active contravention of the law.

"On the fundamental question of principle there will never, I fear, be complete universal agreement, as there will always be some people who object to killing any animal, however badly it may be crippled or injured; and I have seen many instances of this recently when on a tour to visit the veterinary colleges and animal hospitals of India. I saw dozens of aged, injured and otherwise incapacitated and useless cattle—some in the streets of the big cities and others in compounds which had been provided for them—and in which they were well fed and looked after—by wealthy and philanthropic Hindoo benefactors, who supply them with sufficient food and water to keep them alive under the idea that they owe them this duty. They are, as it were, old pensioners. In India there are millions of old cows kept alive solely because their owners by their religion consider that they owe them a duty, the duty of keeping them alive.

To us, with Western ideas, the debt we owe to those which are aged, injured or crippled is definitely to see to it that they have a humane and painless end. . . .

"It is good that the old-fashioned method of stunning cattle with the pole-axe before killing has given way to the use of the humane killer, for the miss-hits which inevitably followed the use of the former caused much unnecessary suffering. In the same way the use of the electro-lethaler for the previous stunning of the bacon pig and the smaller food animals is a great advance both in respect to humane killing and the convenience of the workers. . . .

"Even to those we term "vermin" we still owe a duty, although admittedly often difficult to carry out, the duty of destruction without unnecessary suffering—for even a rat and a mouse have nerves—and as for the use of the steel trap, you all know of the campaign which culminated in failure to pass the House of Lords by some six or seven votes only a few months ago, but which will be presented again on the first opportunity. Truly do we owe it to animals that when we deliberately encompass their deaths we shall do it mercifully and painlessly, and the present-day steel trap certainly does not do this.

"In the surgical and medical treatment of disease much advance has been made on the animal side as well as on the human, and the Animals Anaesthetic Act, of 1919, enforces the use of an anaesthetic (of sufficient potency to prevent the feeling of pain) for operations on animals over the age of six months, and this, with certain exceptions which the law allows, it is our duty to see enforced.

"It is a matter for congratulation to note how very much greater interest is nowadays taken in the rational feeding of all animals—both that of the farm animals of the country and the household pets of the town, for it is now recognised that disease follows improper and irregular living just as much with animals as with human beings. In fact, we in the veterinary world know full well that the diseases of our patients which are the results of this are as numerous as is the case in the human patients of the medical man.

"The feeding, watering and humane treatment of animals and poultry during transport is provided for by Ministry regulations, and the recent Bill against the exportation of the work-worn border-line horse, which owes so much to Sir George Cockerill, of the International League against the Exportation of Horses, has finally put the last nail in the coffin of the decrepit horse traffic against which the late Miss Cole made such a gallant and successful fight.

"And here it will not be inopportune to say that no such thing as 'decrepit' horse traffic now exists, nor has existed since 1919, when the Ministry of Agriculture placed the matter in the hands of their Veterinary Department. No horse which is blind or in the slightest degree lame, or over eight years of age (unless of more than £25 value) can possibly get away from these shores without the sanction of the veterinary officer at the port of embarkation, an officer being always on duty to see that the regulations are carried out."

Sir Frederick concluded by appealing to the owners of pets to ensure that they should be fed on a rational system, that when ill they should be afforded treatment by a veterinary surgeon and not by a quack, and, when the time came, a painless end.

Correspondence

Letters to the Editor should reach the Office not later than by the first post on Tuesday morning for insertion in following Saturday's issue.

All correspondence must bear the name and address of the contributor for publication.

The views expressed in letters addressed to the Editor represent the personal view of the writer only and must not be taken as expressing the opinion or having received the approval of the N.V.M.A.

* * * * *

ACCREDITED LICENCES

To the Editor of the Veterinary Record

Sir,—I am afraid that in the present state of affairs there will be a good deal of variation between the standard adopted by some authorities for accredited licences (if any standard has been adopted at all) and the conditions considered necessary by others for the title of "an accredited herd."

Those whose knowledge of cow-houses is not merely local and narrow will not wonder at the variation in the number of accredited licences granted in different counties. The points necessary for the bringing up of cow-houses to accredited licence standard are more easily carried out when the cow-houses are in close proximity to towns and cities than when they are widely distributed in big widespread counties, while if statutory duties have been conscientiously carried out they are more likely to be of accredited standard: they will have been better supervised and consequently many of them will be in a better state for producing clean milk than will many of the cow-houses in the country. The fact that labour is more easily obtainable where farms are not too far away from cities and towns will have some influence in the matter.

I notice that, even now, there is a tendency to evade the cardinal points necessary in the construction of good cow-houses in order to produce clean milk. This tendency only illustrates the vagaries of human nature where there is no compelling force behind prescribed conditions. A good hunter does not regularly go through a hedge or a gate in order to keep up with the hounds. Clean milk will never be produced in unsuitable cow-houses, half or quarter standardised or modernised.

There is a Ministry of Agriculture and Fisheries publication on "The Construction of Cow-houses with Plans." One wonders how many of the present cow-houses conform to the standard therein prescribed and how many "accredited herds" are really entitled to the description.

Yours sincerely,

G. Mayall, M.R.C.V.S.

Bolton.
June 6th, 1938.

* * * * *

THE MINISTRY'S PANELS

To the Editor of the Veterinary Record

Sir,—One has wondered how long it would be before dissatisfaction with the methods of the Ministry of Agriculture would come out into the open and now it has occurred. At the meeting of the South-Eastern Veterinary Association on April 7th, at Maidstone, I moved the following resolution:—

"In the opinion of this Association the action of the Ministry of Agriculture and Fisheries in depriving the part-time inspectors of the work formerly done by them under the various local authorities is a serious financial hardship to these inspectors and will lead to the denudation of the countryside of country practitioners to the great detriment of agriculture.

"We request the National Veterinary Medical Association to bring this matter forward as a matter of urgency for the serious consideration of the Ministry of Agriculture and Fisheries."

The resolution was dropped as I was advised at the meeting that the best procedure was for the Secretary to be notified of individual cases of hardship. My case was forwarded by the Secretary to the N.V.M.A. and handed on to the Society of Veterinary Practitioners—which I believe is the routine beloved of the Ministry.

The case recorded in your columns seems quite justifiably to be capable of being regarded as scandalous. Some few years ago I lost a market by extension of the borough but in this instance I received compensation under an order of the Ministry of Health. Surely the least the Ministry of Agriculture could do as the taking over authority would be to obtain or provide compensation for those dispossessed by its activities. When you compare the treatment of those who are brought into contact with the two Ministries it can only be to the detriment of the Ministry of Agriculture which seems to do nothing except for its own immediate staff. Unfortunately in regard to the above market I only obtained half the compensation owing to my attendance at the small market now taken away, together with other inspection work, by the Ministry of Agriculture—as though, having performed the work for over 30 years to the satisfaction of the county council, I was only considered good enough for Panel "B" which I take it is available for any experienced practitioner without special experience of veterinary inspectorate work. Naturally I did not consider it an attractive offer. But it is not only Panel "B" but Panel "A" also that has been penalised and sometimes very severely under the harsh terms and inadequate scale of fees imposed by the Ministry. A practitioner on Panel "A" has:

(*a*) To provide his own waterproof clothing. In my case some years ago an offer of free clothing was made by the local authority but as I was already provided the offer was not accepted.

(*b*) To provide his own microscope and centrifugal outfits representing an outlay of £40 or £50. The Ministry in some cases is purchasing these outfits from local authorities and as these outfits are not for the part-time officers presumably they are for their whole-time staff.

The Ministry is afraid the part-time man will be too well recompensed. Personally, my fear is the other way and that, though both classes are professional men, they will not be equally fairly treated though such should be the case.

In view of the fact that there is no guarantee of work to be done and that this appears to be of a stop gap order, it seems that the very least that could be done would be to provide apparatus, or in the event of the Ministry not doing so, to pay a retaining fee to their staff to meet the cost of apparatus and as holding themselves in reserve to the Ministry. This appears to be all ruled out by the Ministry and it is not surprising that there is rising indignation in the country at the ungenerous methods of the Ministry of Agriculture which are not at all comparable with those of the Ministry of Health.

Yours faithfully,
HUGH P. HOGBEN.

Folkestone.
June 6th, 1938.

* * * * *

SEPTIC CONDITION IN A SEALYHAM

TO THE EDITOR OF THE VETERINARY RECORD

Sir,—For the past five months I have been treating a Sealyham dog aged five years for a septic condition the cause of which I have not discovered.

The first symptoms to appear were stomatitis with salivation, conjunctivitis with swollen eyelids and high fever.

With the many forms of treatment the fever and the other symptoms varied but never abated and the dog steadily lost condition. The appetite was variable and the dog was always willing to take exercise.

An autogenous vaccine was made from swabs from eyes and mouth and injected as directed. Many other preparations suggested for septicaemias and toxaemias were tried, all without result, in conjunction of course with local treatment and various changes in diet.

The dog now looks a wreck, with severe chronic stomatitis and conjunctivitis and I am at a loss to know what steps to take as the owner is very fond of the animal and anxious to save its life.

Perhaps some of your readers have encountered similar cases and could help me with their experiences.

Yours faithfully,
R. H. LAMBERT.

South Richmond Street,
Dublin.
June 2nd, 1938.

* * * * *

ROYAL COLLEGE OF VETERINARY SURGEONS

Election of Council, 1938

TO THE EDITOR OF THE VETERINARY RECORD

Sir,—I wish, through the courtesy of your columns, to thank most sincerely all those responsible for my election to Council.

It will be my endeavour, at all times, to fulfil my obligations so far as I can.

Yours faithfully,
J. W. PROCTER.

3, The Crescent,
York.

. . . . .

TO THE EDITOR OF THE VETERINARY RECORD

Sir,—I should be grateful if you would allow me to thank those members of the profession who recorded their votes for me at the recent election for the Council. I appreciate their continued confidence very much.

Yours faithfully,
G. K. WALKER.

Abingdon.
June 7th, 1938.